PB89-117410

Superfund Record of Decision (EPA Region 4): Zellwood Groundwater Contamination Site, Zellwood, Florida First Remedial Action

(U.S.) Environmental Protection Agency
Washington, Dc

17 Dec 87

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16. Abstract (Limit: 200 words)

The 57-acre Zellwood site is located in the northwestern corner of Orange County, Florida, approximately one-half mile west of the unincorporated town of Zellwood. Situated in a rural area, the site is occupied by four industries and an open field containing a marshy wetland area. Approximately 300 homes within a one-mile radius of the site depend on private wells as their sole source of potable water. Between 1963 and 1971, Drum Service Company of Florida, a drum recycling facility, operated wastewater disposal system without a regulatory permit, treating and disposing of generated wastewaters in two onsite evaporation/percolation ponds. In 1980, the company eliminated the use of these ponds for waste disposal and in August 1981 initiated drainage and removal of contaminated sediments from the ponds. Douglas Fertilizer and Chemical Company and Southern Liquid Fertilizer discharge wastewater from their production process into three unlined surface impoundments. Additionally from 1960 to 1983, the Zellwin Farms Company facility, a vegetable washing and packing plant, discharged wastewaters from the vegetable washing process into a ditch. From 1971 through 1985, the Drum Service Company has had various types of waste treatment and disposal permits issued by the Florida Department of Environmental Regulation (FDER). To date, the Douglass Fertilizer and Chemical Company and the Zellwin Farm Company have
(See Attached Sheet)

17. Document Analysis a. Descriptors

Record of Decision
Zellwood, FL
First Remedial Action - Final
Contaminated Media: gw, sediments, sludge, soil
Key Contaminants: chromium, inorganics, organics, pesticides, toluene

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 83
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Superfund Record of Decision:

Zellwood, FL

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EPA/ROD/R04-88/031
Zellwood, FL
First Remedial Action - Final

16. ABSTRACT (continued)

not been permitted by FDER. In December 1982, EPA representatives discovered an abandoned drum storage area in the northern section of the Zellwood site. Based on unsubstantiated reports from area residents, material in this drum storage area may have been there for more than 20 years. In the fall of 1983, EPA oversaw a PRP removal action of the abandoned drum area. The primary contaminants of concern affecting the ground water, soil, sediments, and sludge include: organics, inorganics, metals, and pesticides.

The selected remedial action for this site includes: excavation of soils and sediments with onsite incineration and testing of residuals to determine appropriate disposal; ground water pump and treatment with flushing of the treated ground water back through the abandoned drum area to facilitate cleanup of residual contamination; and a long term ground water monitoring program for private potable water wells. The estimated present worth cost for this remedial action ranges from $41,264,244 to $61,908,244 with estimated present worth O&M of $13,543,244 (excluding ground water treatment and remediation). The present worth range incorporates variations in the soil and sediment volume that will be incinerated.

DECLARATION FOR THE
RECORD OF DECISION

SITE NAME AND LOCATION

Zellwood Groundwater Contamination Site, Zellwood, Florida

STATEMENT OF PURPOSE

This decision document represents the selected remedial action for this site, developed in accordance with CERCLA, as amended by SARA, and to the extent practicable, the National Contingency Plan.

The State of Florida has not concurred on the selected remedy.

STATEMENT OF BASIS

This decision is based upon the administrative record. The attached index for the administrative record upon which the selection of a remedial action is based identifies the items which comprise the administrative record.

DESCRIPTION OF THE SELECTED REMEDY

-Excavation of soils/sediments in the three on-site ditches, the existing abandoned drum area ponds, the temporary sludge storage area, the two former perculation ponds, and the waste piles;

-On-site thermal destruction of the excavated soil/sediment;

-Appropriate leach testing and disposal of the incinerated soil;

-Groundwater removal and treatment for the shallow aquifers. ARARs will be used as clean-up and treatment criteria.

-Flushing the treated groundwater back through the abandoned drum area, to clean up the residual contamination;

-An attempt will be made to locate and plug up any abandoned wells or boreholes in the area;

-A long-term monitor program for the private potable water wells in the area.

DECLARATION

The selected remedy is protective of human health and the environment, attains Federal and State requirements that are applicable or relevant and appropriate, (or that a waiver can be justified for whatever ARARs which will not be met), and is cost-effective. This remedy satisfies that preference for treatment that reduces toxicity, mobility, preference for treatment that reduces toxicity, mobility, or volume as a principal element. Finally, it is determined that this remedy utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable.

DEC 17 1997

Date

Lee A. DeHihns, III
Acting Regional Administrator

SECTION I
SITE LOCATION AND DESCRIPTION

The Zellwood Groundwater Contamination Site is located in the northwestern corner of Orange County, Florida; approximately one-half mile west of the unincorporated town of Zellwood. The 57-acre site, as shown in Figure 1-2, consists of an area occupied by four industries and an open field with a marshy wetlands area.

The site is situated in a rural area. Small residential communities are located to the north and to the east; agricultural lands to the south and west. There are approximately 300 homes within a one-mile radius of the site. These homes depend on private wells as their sole potable water supply. In addition, Zellwood Water Users, Inc. has two public water supply wells within a half mile east of the site servicing about 700 to 800 people. Besides the industries and the residences, there are several plant nurseries, vegetable growing operations, and citrus groves.

The industrialized section of the site has been occupied since the 1960's by Zellwin Farms Company and Drum Service Company of Florida. In the early 1970's, Southern Liquid Fertilizer Company began their on-site operation. The business was operated until 1981 when the plant was purchased and operations were assumed by the Douglass Fertilizer and Chemical Company. Douglass Fertilizer sold the property and moved its operation to a new off-site location in 1984. The former fertilizer production area is now occupied by Coatings Application and Waterproofing Company. Chemical Systems, Incorporated, located on the western part of the site, commenced operations in 1982.

SECTION II
SITE AND REGULATORY HISTORY

LAND USE

Prior to 1963 when the Drum Service Company of Florida was established, the area was almost entirely composed of agriculturally-related businesses such as citrus groves, nurseries, farmland, and muck farming. The majority of residences north of the site and the Willow Street Community Center have been established since 1965.

The Zellwood Groundwater Contamination Site is currently occupied by four active businesses: Drum Service Company of Florida, Chemical Systems of Florida, Zellwin Farms Company, and the former fertilizer area is occupied by Coatings Application and Waterproofing Company. In addition, several other businesses are located in the industrial area surrounding the site. Adjacent to the Zellwin Farms facility is a migrant worker hotel.

Approximately one-half mile north of the site are several residential developments and the Willow Street Community Center. Adjacent to the site on the south side are muck farms, and the remaining areas surrounding the site are composed of citrus groves and pastureland. A main traffic artery, U.S. Highway 441 is located less than one-half mile east of the site.

Land use in a one-mile radius of the site can be divided into five major categories. Agriculture, primarily muck farms and citrus groves accounts for 74 percent of the area's land use. Residential uses total 10 percent, followed by commercial industrial and transporation areas ocupying 9 percent. Seven percent of the land area is combined lake and wetland areas.

PREVIOUS SITE ACTIVITIES

Drum Service Company of Florida, a drum recycling facility, began operations in 1963. In the course of recycling used drums, wastewaters were generated through the draining and cleaning procedures. From 1963 until 1975, the Company used two on-site evaporation/percolation ponds for treatment and disposal of the wastewater. In 1980, the Company redesigned its treatment system, eliminating the use of the ponds for waste disposal.

Drainage and removal of contaminated sediments from the two ponds was initiated in August 1981. The sediments were collected and initially disposed of in the Astatula Landfill in Lake County, Florida. After August 21, 1981, the landfill operators changed their policy and refused to accept the wastes because the sediments had been generated in another

county. To complete the clean-up of the two ponds, Drum Service Company of Florida constructed a temporary sludge storage area consisting of an earthen berm at the western edge of the drum storage area. The sludge was subsequently removed from the temporary storage area during October and November 1982, and hauled to the Brevard County Shredder Landfill. The areas where the ponds had been located were filled in and are presently used for parking and drum storage and the area where the temporary sludge storage area existed is now used for drum storage.

Douglass Fertilizer and Chemical Company and the previous business, Southern Liquid Fertilizer, had three unlined surface impoundments which received wastewater from their production process. The company is no longer at this location and as of 1985 water remained in only the easternmost pond.

Chemical Systems, Inc., located northwest of the Drum Service Company of Florida, is a small facility producing cleaning products for the citrus concentrate industry. Reportedly, this company does not generate either solid or liquid wastes.

The Zellwin Farms Company facility is a vegetable washing and packing plant. From 1960 to 1983, all waters from the vegetable washing processes were discharged to the southern ditch paralleling Jones Avenue. In 1983, water from the carrot and radish cooling process and the run-off from the Zellwin Farms parking lot area north of the Jones Avenue facility were diverted to a drainage ditch south of their facility south of Jones Avenue. The remainder of the water is still discharged to the southern ditch.

In December 1982, representatives of the EPA discovered the abandoned drum storage area located on an approximately 6-acre field north of the northern ditch and south of the Seaboard Coastline Railroad in the northern section of the Zellwood Groundwater Contamination Site. The abandoned drum area was apparently used for the disposal of drums and other wastes. Based on the unsubstantiated reports from residents in the area some of the material may have been there from more than 20 years.

The Zellwood site was listed on the first final National Priorities List: which was published in the Federal Register in 1983. In the fall of 1983, EPA's Region IV Emergency Response Control Section (ERCS) oversaw a PRP removal action of the abandoned drum area of the site. In 1984, a Remedial Action Master Plan was developed and a Work Plan for the RI/FS was formulated. Negotiations with the PRPs were initiated, but it was indicated by the PRPs that they did not wish to implement the EPA Work Plan. EPA, via its contractor NUS-FIT, implemented the RI/FS in 1985.

REGULATORY ACTIONS

Between 1963 and 1971, Drum Service Company of Florida operated its wastewater disposal system without a regulatory permit. In 1971, Drum Service Company of Florida applied for and was granted Florida Department of Environmental Regulation (FDER) Operation Permit No. IC-1308. The permit was granted for a wastewater treatment system using evaporation and percolation ponds for treatment and disposal of wastes from the plant. In 1975, the system was redesigned to eliminate ponds except for temporary storage of wastewater. FDER issued Operation Permit No. IO48-2077 for this system on July 31, 1975. In 1980, further design changes were made eliminating use of the ponds for storage of wastewater. As of 1985, Drum Service Company of Florida held FDER Permit No. AO48-27470B to operate a drum reclamation furnace for processing used drums by burning and melting the interior residue, and subsequent coating of interior and exterior drum surfaces.

The Douglass Fertilizer and Chemical Company and the Zellwin Farm Company have not, in the past nor currently, held any industrial waste treatment of disposal permits. Chemical Systems, Inc. reportedly did not generate either solid waste or wastewater, and thus would not have a permit.

In March 1986, the Florida Department of Environmental Regulation filed suit against the Drum Service Company for failure to comply with applicable air regulations. As of the date of this ROD, the outcome of the suit is unknown.

SECTION III
CURRENT SITE STATUS

SITE GEOLOGY AND HYDROGEOLOGY

The Zellwood site is underlain by an unconfined surficial aquifer and the artesian Floridan aquifer. Regionally, the water level ranges from immediately below ground surface to greater than twenty feet below ground surface. The shallow aquifer fluctuates in response to recharge and discharge mechanisms and seasonal fluctuation of up to ten feet are not uncommon. At the site, the hydraulic gradient ranges from 0.35 to 0.63 feet per 100 feet, which is somewhat steeper than is regionally normal. This may be due to continual pumping of surface water out of the muck farm area directly south of the site. The general direction of flow is to the south-southwest.

Separating the surficial and Floridan aquifers is the Hawthorne Formation. In the area, the Hawthorne consists of a green to yellowish-green clay which is underlain by a brown to white dolomite or dolomitic limestone. A clay-like sand layer in the upper Hawthorne retards the vertical movement of water between the surficial aquifer and the limestone of the Floridan. The dolomites and limestones of the lower Hawthorne may be considered to be hydraulically part of the Floridan.

Underlying the Hawthorne is the Floridan aquifer. This aquifer is the major source of potable water for people living near the Zellwood site.

Regional potentiometric surface maps indicate a northeasterly direction of groundwater flow in the Floridan aquifer. The water level measurements taken in the Floridan aquifer wells at the site in May, June, and September were plotted and contoured. Examination of this data confirms a divergency from the normal northeasterly flow and suggests that water levels at the site are not representative for the determination of a regional flow direction in the Floridan aquifer. The anomalies of the potentiometric surface of the Floridan aquifer could be an effect of numerous factors including a structural depression at the top of the Ocala Formation, local pumpage of municipal and industrial wells, and localized flow patterns within the solution channels of the Floridan aquifer. Also, one of the three deep monitor wells was set in a solution channel immediately below the Hawthorne Formation while the other two were set in the limestone of the Floridan aquifer. Conservatively, it may be assumed that in the site vicinity, flow in the Floridan aquifer is radially away from the site for a limited distance before the regional northeastern flow direction becomes dominant.

PREVIOUS SITE INVESTIGATIONS

Numerous investigative activities have taken place at the Zellwood Groundwater Contamination Site since 1980. Following are a few of these activities:

- The FDER collected wastewater samples from two ponds on Drum Service Company of Florida in July 1980. Several heavy metals were identified in the samples.

- In April 1981, the FDER analyses of groundwater samples taken from temporary monitor wells on Drum Service Company, and downgradient of Southern Liquid Fertilizer, indicated the presence of several contaminants. A sample collected from a well located between a pond on Drum Service Company and the large pond on Southern Liquid Fertilizer showed the presence of arsenic. A surface water sample was also collected from the large pond on Southern Liquid Fertilizer.

- In November 1981, Drum Service Company of Florida contracted Seabury and Bottorf Associates, Inc. to conduct a soil and water sampling investigation along the right-of-way of the Seaboard Coastline Railroad. Samples were collected from three locations along the railroad and analyzed for residual arsenic. Arsenic concentrations ranging from 5.89 milligrams per kilogram (mg/kg) to 5.96 mg/kg were found in the soil at each of the three locations.

- Geophysical studies conducted by the FDER in 1981 and the Ecology & Environment Inc., (E & E) Field Investigation Team (FIT) in April and July 1982, indicated the presence of possible groundwater contamination plumes on the south side of both Drum Service Company and Douglass Fertilizer Company.

- During July and August 1982, FIT (E & E) conducted a sampling investigation and installed six groundwater monitor wells in three locations. Surface water and sediment, soil, and groundwater samples were collected for analyses. Much of the data was unusable because of QA reasons.

- The EPA Environmental Services Division (ESD) conducted a hazardous waste site field investigation during December 1982. Several metals and organic compounds were detected in the soil/sediment and water samples. Of particular interest, were the cadmium and lead that were found in two potable water wells.

- The ESD resampled two private wells in April 1983. The two metals of concern, cadmium and lead, were not detected in either sample.

These were the investigations that took place prior to the initiation of the Remedial Investigation and Feasibility Study.

SECTION IV
REMEDIAL INVESTIGATION RESULTS

DESIGN OF THE REMEDIAL INVESTIGATION

Previous studies at the Zellwood Groundwater Contamination Site indicated several major concerns. The combined factors of the shallow water table and the known waste disposal/treatment practices led to the public health concern of possible groundwater contamination. Another concern is the transport of contaminants via the drainage ditches since these ditches have historically been collection points for run-off of potentially contaminated surface water and soil. A third concern is the potential public health threat that may have existed from contaminant migration and/or direct contact with on-site contaminants or waste.

Groundwater quality in both the surficial and Floridan aquifers and the other potential contamination migration routes were investigated during the RI. The investigation included a subsurface boring program, installation of 17 monitor wells, groundwater sampling and analysis, and data evaluation.

Surface water and sediment samples were also collected from ditches within the study area. The results were compared with previous study results to assess changes in water quality and sediment contaminant levels. The contaminants found in the surface water and sediment samples were evaluated to identify source areas.

The waste area at the site were identified using historic aerial photographs and geophysical techniques. Surface and subsurface soil samples were collected from these area to evaluate the potential for contaminants to migrate to groundwater. The results of the analyses were also used to estimate the vertical extent of contamination.

CONTAMINANTS OF CONCERN

All of the samples taken for the RI were analyzed for the chemicals on the CLP Hazardous Substance List. In addition, the water samples were analyzed for the standard parameters and for sulfates.

The results of the investigation indicated that a varied assortment of chemical contaminants were found at the site. In an attempt to focus the interpretation of the results, a screening process was initiated as part of the RI. The screening process was a qualitative "best engineering judgement" process that took into account present site conditions; physical, chemical and environmental rate and mobility of the contaminants; number of different mediums that were found to contain the individual contaminants; and qualitative health effects and the environmental impacts associated with exposure to the contaminants. The resulting list of contaminants can be found in Table 1. The list in Table 1 is used for

TABLE ONE

Chromium

Lead

Mercury

Cyanide

Nitrite

Toluene

Phenol

DDT/DDE/DDD

Arsenic

Cadmium

Chlordane

Potassium

Total Phosphorus

Ammonia

Zinc

Aluminum

Iron

Silver

TABLE TWO

Arsenic

Benzo (a) pyrene

Chlordane

Chromium

Nitrate-Nitrite nitrogen

Cyanide

purposes of clarity throughout most of this ROD. It should be made clear at this juncture that this list in no way represent the sum total of chemicals found in each sample.

There is only one area that a different subset of chemicals was selected for evaluation. This different subset can be found in Table 2. This subset was developed using the "indicator chemical" process found in the Superfund Public Health Evaluation Manual (draft December 17, 1985, EPA). The sole purpose of the list was to evaluate the risk to public health that would remain if no remedial action was taken. The only place this list is utilized is in Section V of this ROD.

SOILS INVESTIGATION

Soil samples were taken in several designated areas of the site. The designated areas were: 1) Abandoned drum area; 2) former Drum Service perculation ponds; 3) temporary sludge storage area; 4) railroad right-of-way; and 5) current Drum Service area. The soil sampling locations can be seen on Figures 3-10 and 3-14.

Subsurface Soil

Twelve subsurface soil samples were collected from the historic waste areas throughout the site. The samples were collected by augering from 6 to 18 inches and from 2 to 3 feet. For presentation of the data, the subsurface soil samples have been grouped into two categories; abandoned drum area and other areas.

The selected contaminant results of the subsurface soil samples from the abandoned drum area are presented in Tables 3-15 and 3-28, respectively. The analytical results of subsurface soil samples from the other areas are presented in Tables 3-19 and 3-28.

SURFACE WATER AND SEDIMENT INVESTIGATION

Several areas were sampled as part of the surface water/sediment portion of the investigation. These areas are 1) the northern, middle and southern ditches; 2) the four ponds in the abandoned drum area; and 3) the three ponds on the former Douglass Fertilizer Company property. The sampling locations can be seen on Figure 5-5.

NORTHERN DITCH

The northern ditch begins at the northeast boundary of the site and travels westerly along the northern site border then south of the abandoned drum area. At the eastern boundary, the northern ditch flows under the railroad tracks and south toward the southern ditch.

TABLE 5-31
COMPARISON OF SELECTED CONTAMINANTS IN SEDIMENT
NORTHERN DITCH - SOUTH AND WEST OF ABANDONED DRUM AREA
ZELLWOOD GROUNDWATER CONTAMINATION SITE
ORANGE COUNTY, FLORIDA

Parameter (ug/kg)	SS-1 (Control) 2/83	SS-9 2/83	SS-10 2/83	SS-17/D-85 2/83	SS-17/D-85 12/82	SS-16 2/83	SS-31 2/83
Arsenic	-	20,000J	80,000J	20,000J	9,700	-	-
Chromium	-	100,000	140,000	90,000	120,000	6,300	5,600
Lead	6,000J	200,000J	2,000,000J	800,000J	280,000	-	8,000J
Mercury	-	3,300	9,800	1,800	19,000	-	150
Cyanide	-	R	R	R	3,000	-	-
Nitrate-Nitrite N	-	R	R	R	NA	R	R
Toluene	-	33J	5,800J	-	5J	-	23J
Phenols	-	-	-	-	-	-	-
0,0'-DDT	20	-	-	-	NA	-	-
0,0'-DDE	240	1,700C	17,000	4,200	NA	21	140
0,0'-DDD	700C	-	-	310N	NA	21N	32
Chlordane	-	36,000N	96,000N	25,000N	NA	340N	1,400N
Gamma-chlordane	800	NA	NA	NA	-	NA	NA

- Material was analyzed for but not detected.
J Estimated value.
R Quality Control indicates data not useable.
NA Not analyzed.
N Presumptive evidence of presence of material.
C Confirmed by GC/MS.

TABLE 5-30
COMPARISON OF SELECTED CONTAMINANTS IN SEDIMENT
NORTHERN DITCH EAST OF THE ABANDONED DRUM AREA
ZELLWOOD GROUNDWATER CONTAMINATION SITE
ORANGE COUNTY, FLORIDA

Parameter (ug/kg)	SS-1 (Control) 2/85	SS-5 2/85	SS-3 2/85	SS-4 2/85	SS-6 2/85	SS-7 2/85
Chromium	-	-	20,000	10,000	64,000	69,000
Lead	4,000J	20,000J	50,000J	70,000J	200,000J	200,000J
Mercury	-	-	95	140	500	1,900
Cyanide	-	-	-	-	-	R
Nitrate-Nitrite N	-	-	13,000	7,000	8,200	R
Toluene	-	-	-	-	-	47J
Phenols	-	-	-	-	-	-
4,4'-DDT	20	3.3	40	160	310N	-
4,4'-DDE	240	21	140N	720N	1,200	4,500
4,4'-DDD	740C	3.9	17	84	180N	-
Chlordane	-	-	130	740N	2,500N	11,000N
Gamma-chlordane	800	NA	NA	NA	NA	NA
Arsenic	-	-	11,000	-	-	R
Iron	220,000	560,000	9,500,000	4,800,000	11,000,000	5,100,000

- Material was analyzed for but not detected.
R Quality control indicates data not useable.
J Estimated value.
N Presumptive evidence of presence of material.
C Confirmed by GC/MS.
NA Not analyzed.

Surface Water

The nature of the surface water contaminants found in the northern ditch is presented in Table 5-29. This table also incudes the results of the analyses of a sample collected at a sample location similar to SW-17 (designated as D-8) during the EPA December 1982 investigation. This table indicates that a variety of contaminants, not present in the control sample, were found in the surface water samples collected at all three locations.

Sediment

Table 5-30 and 5-31 present the concentrations of contaminant in sediment samples collected in the northern ditch east as well as south and west of the abandoned drum area, respectively. Chromium, mercury, and chlordane were found in the sediment of the northern ditch east of the abandoned drum area (SS-3, SS-45, SS-6, and SS-7) although the contaminants were not found in the sediment of the northern fork of the northern ditch (SS-1, SS-5). These three contaminants were also present in the composite surface soil samples collected from the drum storage area. The presence of these contaminants appears to be related to run-off in surface soils in the drum storage area and possibly from active operations of drum storage. A comparison of the concentrations of iron and lead in samples collected east of the abandoned drum are (SS-3, SS-4, SS-6 and SS-7) with the surface soils of the abandoned drum area and drum storage area substantiates the run-off asumption. Table 5-32 presents the concentrations of contaminants in areas that could be providing a source of contamination to the northern ditch. Six extractable organics were also detected in the southern fork of the northern ditch.

The concentrations of chromium, mercury, lead, and chlordane are one to two orders of magnitude higher in sediment samples south and west of the abandoned drum area (SS-9, SS-14 and SS-17) than in other areas of the northern ditch. The high concentrations of these contaminants suggest that this area is receiving run-off from the abandoned drum area and overflow from the large pond located on the southwest part of the abandoned drum area. The samples from the area south of the abandoned drum area (SS-9 and SS-14) also contained toluene, ethylbenzene, xylenes, acetone, bis(2-ethylhexhl)phthalate and DDT and its derivatives. The operations in the drum storage area may also be effecting the nature and concentration of contaminants in samples collected from these two locations (SS-9 and SS-14).

Samples were also collected west of the abandoned drum area at locations SS-17, SS-16 and SS-31. The nature and concentration of contaminants in the sediment sample at the west end of the northern ditch (SS-17) are similar to those in the sediment samples collected east of the abandoned drum area (SS-3, SS-4, SS-6 and SS-7). This suggests that a source of contamination may be run-off from operations conducted in the active drum storage area.

TABLE 3-15
MAXIMUM CONCENTRATIONS OF SELECTED CONTAMINANTS IN SUBSURFACE SOIL
ABANDONED DRUM AREA
ZELLWOOD GROUNDWATER CONTAMINATION SITE
ORANGE COUNTY, FLORIDA

	AG-1, AG-2, AG-3		NA-1
Parameter (ug/kg)	Shallow (6" - 18") 2/85	Deep (2' - 3') 2/85	Waste Piles And Drums 12/82
Chromium	200,000	5,700	1,200,000
Lead	800,000J	7,000J	5,600,000
Mercury	2,000	110	13,000
Cyanide	2,800	-	10,000
Nitrate-Nitrite-N	NA	NA	NA
Toluene	180	240	10,000
Phenols	-	-	-
4,4'-DDT	330	-	NA
4,4'-DDE	1,300	-	NA
4,4'-DDD	-	-	NA
Chlordane	44,000	70J	NA
Gamma Chlordane	NA	NA	18,000
Alpha Chlordane	NA	NA	7,300
Cadmium	3,500	-	28,000

J Estimated value.
- Material was analyzed for but not detected.
NA Not analyzed.

TABLE 3-22
MAXIMUM CONCENTRATIONS OF SELECTED CONTAMINANTS IN SUBSURFACE SOIL
DRUM SERVICE COVERED PONDS
ZELLWOOD GROUNDWATER CONTAMINATION SITE
ORANGE COUNTY, FLORIDA

Paramater (ug/kg)	Northern Pond (AG-5/A)		Southern Pond (AG-6/A)	
	12/82	2/85	12/82	2/85
Chromium	3,300	13,000	18,000	3,000
Lead	7,000	30,000J	35,000	-
Mercury	190	760	500	-
Cyanide	190	-	1,000	-
Nitrate-Nitrite N	NA	NA	NA	NA
Toluene	-	22	-	1J
Phenols	-	-	-	-
4,4'-DDT	NA	120	NA	-
4,4'-DDE	NA	68	NA	5JN
4,4'-DDD	NA	-	NA	-
Chlordane	NA	3,200	NA	-
Gamma-Chlordane	-	NA	5.9	- NA
Alpha-Chlordane	-	NA	5.6	NA

- Material was analyzed for but not detected.
J Estimated value.
NA Not analyzed.

TABLE 3-28
COMPARISON OF SELECTED CONTAMINANTS IN WASTE PILES
NORTH OF ABANDONED DRUM AREA
ZELLWOOD GROUNDWATER CONTAMINATION SITE
ORANGE COUNTY, FLORIDA

Parameter (ug/kg)	CS-5 Waste Pile 2/85	SS-40 Waste Pile 2/85
Chromium	320,000	14,000
Lead	3,000,000J	100,000J
Mercury	41,000	300
Cyanide	-	-
Nitrate-Nitrite N	R	5,400
Toluene	990,000J	-
Total Xylenes	1,200,000	-
Phenols	-	-
4,4'-DDT	-	52
4,4'-DDE	40,000	590
4,4'-DDD	-	100N
Chlordane	-	470N

J Estimated value.
- Material was analyzed for but not detected.
R Quality Control indicates data not useable.
N Presumptive evidence of presence of material.

TABLE 3-19
MAXIMUM CONCENTRATIONS OF SELECTED CONTAMINANTS IN SUBSURFACE SOIL
TEMPORARY SLUDGE STORAGE AREA
ZELLWOOD GROUNDWATER CONTAMINATION SITE
ORANGE COUNTY, FLORIDA

Parameter (ug/kg)	AG-4A 2-3 ft 2/85	PT-1 Composite 12/82
Chromium	-	5.
Lead	-	320
Mercury	76	220
Cyanide	-	1,500
Nitrate-Nitrite-N	NA	NA
Toluene	53	-
Phenols	60J	-
4,4'-DDT	-	NA
4,4'-DDE	-	NA
4,4'-DDD	-	NA
Zinc	-	200,000
Aluminum	1,600,000	3,700,000
Iron	-	22,000,000

- Material was analyzed for but not detected.
J Estimated value.
NA Not analyzed.

TABLE 5-36
COMPARISON OF SELECTED CONTAMINANTS IN SEDIMENT
MIDDLE DITCH
ZELLWOOD GROUNDWATER CONTAMINATION SITE
ORANGE COUNTY, FLORIDA

Parameter (ug/kg)	SS-1 (Control) 2/83	SS-21 2/83	SS-19/D-6S 2/83	SS-19/D-6S 12/82	SS-20 2/83	SS-18/D-7S 2/83	SS-18/D-7S 12/82
Chromium	-	5,900	3,400	2,400	5,900	90,000	55,000
Lead	9,000J	10,000J	50,000J	51,000	10,000J	400,000J	220,000
Mercury	-	-	130	720	1,000	-	560
Cyanide	-	R	-	420K	-	-	300
Nitrate-Nitrite N	-	R	R	NA	R	R	NA
Toluene	-	-	-	NAI	123	193	22
Phenols	-	-	-	N	-	-	-
4,4'-DDT	20	-	-	NA	-	-	NA
4,4'-DDE	240	14	-	NA	-	3,600	NA
4,4'-DDD	760C	-	-	NA	-	-	NA
Chlordane	-	88N	-	NA	-	-	NA
Alpha chlordane	-	NA	NA	-	NA	NA	640
Gamma chlordane	800	NA	NA	-	NA	NA	720
Zinc	-	150,000	30,000	37,000	33,000	2,200,000	880,000
Aluminum	760,000	340,000	120,000	570,000	510,000	10,000,000	4,000,000
Iron	220,000	820,000	400,000	650,000	730,000	8,600,000	2,600,000

- Material was analyzed for but not detected.
J Estimated value.
K Actual value is known to be less than value given.
R Quality Control indicates data not useable.
NA Not analyzed.
N Presumptive evidence of presence of material.
NAI Interferences.
C Confirmed by GC/MS.

TABLE 5-35
COMPARISON OF SELECTED CONTAMINANTS IN SOIL/SEDIMENT
POSSIBLE SOURCES OF CONTAMINATION OF MIDDLE DITCHES
ZELLWOOD GROUNDWATER CONTAMINATION SITE
ORANGE COUNTY, FLORIDA

	AG-4/A*/PT-1 Subsurface Soil Temp. Sludge Area		SS-22 Pond Sediment Douglass Fertilizer
Parameter (ug/kg)	2/85	12/82	2/85
Chromium	-	51,000	200,000
Lead	-	320,000	100,000J
Mercury	76	220	-
Cyanide	-	1,500	R
Nitrate-Nitrite N	NA	NA	R
Toluene	53	-	40J
Phenol	60J	-	-
4,4'-DDT	-	NA	-
4,4'-DDE	-	NA	37
4,4'-DDD	-	NA	6JN
Chlordane	-	NA	400N
Alpha Chlordane	NA	-	NA
Gamma Chlordane	NA	-	NA
Zinc	-	200,000	11,000,000
Aluminum	1,600,000	3,700,000	18,000,000
Iron	-	22,000,000	42,000,000

* Maximum concentration from two depths.
J Estimated value.
R Quality control indicates data not useable.
- Material was analyzed for but not detected.
NA Not analyzed.

The northern ditch flows under the railroad tracks at the western end and then southward toward the southern ditch. As can be seen from Table 5-31 the concentrations of mercury and chlordane in the sediment sample indicate that contaminants have migrated to at least the sample location in the connecting ditch (SS-31).

MIDDLE DITCHES

The middle ditches consist of two parallel pathways north and south of the railroad tracks. Just north of the Douglass Fertilizer building the middle ditch flows northerly under the tracks and proceeds northwesterly toward the northern ditch.

Surface Water

The nature of the surface water contaminants found in the middle ditches are presented in Table 5-33. The table also includes the results of the analyses of samples collected at the same locations as SW-18 (designated D-7) and SW-19 (designated D-6) during the EPA December 1982 investigation. All three samples collected during the RI indicate the presence of lead and chromium. The results from the 1982 investigation also indicated above background levels of lead and chromium in the water samples.

Sediment

Table 5-34 presents the concentrations of contaminants in sediment samples collected from the middle ditches. The results from the EPA December 1982 investigation are also included. The 1982 samples were collected from locations similar to SS-19 and SS-18 and are designated as D-6S and D-7S, respectively. During 1982 EPA investigation, the highest sediment concentrations of all contaminants except cyanide found in the sediment sample collected north of the Douglass Fertilizer building (SS-21) appear similar to those found in the Douglass Fertilizer west pond sediments and therefore may be the result of run-off from the Douglass Fertilizer property. The concentration of contaminants found in the Douglass fertilizer Company west pond are presented in Table 5-35.

The concentrations of iron, aluminum and zinc are highest in the sediment sample collected from the middle ditch north of the rairoad tracks (SS-18). The higher concentration of these contaminants in this sample suggests that this area currently or in the past has received run-off or groundwater seepage from a different source. The temporary sludge storage area is the most likely source for the contaminants. This is substantiated by the comparison of the concentrations of chromium and lead in sample SS-18 to those in the samples from the eastern end of the northern ditch (SS-3, SS-4, and SS-6). Since SS-18 had higher concentrations of chromium and lead than the eastern end of the northern ditch, it has or is being effected by another source. Table 5-35 contains concentrations of contaminants from the subsurface soil samples collected in the temporary sludge storage area that could have effected the middle ditch.

TABLE 5-33
COMPARISON OF SELECTED CONTAMINANTS IN SURFACE WATER
MIDDLE DITCH
ZELLWOOD GROUNDWATER CONTAMINATION SITE
ORANGE COUNTY, FLORIDA

Parameter (ug/kg)	SW-15 (Control) 2/85	SW-18/D-7 2/85	SW-18/D-7 12/82	SW-19/D-6 2/85	SW-19/D-6 12/82	SW-20 2/85
Chromium	-	22	950	430	120	72
Lead	-	100J	5,700	4,000J	3,600	500J
Mercury	-	-	NAI	-	NAI	-
Cyanide	-	-	150	R	110	R
Nitrate-Nitrite N	-	R	NA	R	NA	R
Toluene	-	-	-	-	29	-
Phenols	-	6J	10J	-	5J	-
4,4'-DDT	-	-	NA	-	NA	-
4,4'-DDE	-	0.06J	NA	-	NA	-
4,4'-DDD	-	-	NA	-	NA	-
Chlordane	-	-	NA	-	NA	-
Alpha-chlordane	NA	NA	6.3	NA	.037	NA
Gamma-Chlordane	NA	NA	-	NA	.053	NA

- Material was analyzed for but not detected.
J Estimated value.
R Quality control indicates data not useable.
NA Not analyzed.
NAI Analyses not performed due to interferences in sample.

TABLE 5-29
COMPARISON OF SELECTED CONTAMINANTS IN SURFACE WATER
NORTHERN DITCH
ZELLWOOD GROUNDWATER CONTAMINATION SITE
ORANGE COUNTY, FLORIDA

Parameter (ug/l)	SW-15 (Control) 2/83	SW-16 2/83	SW-17/D-8 2/83	SW-17/D-8 12/82	SW-31 2/83
Chromium	-	20	17	15	190
Lead	-	-	10J	-	900J
Mercury	-	-	-	-	3.0
Cyanide	-	R	R	11	-
Nitrate-Nitrite	-	R	R	NA	-
Toluene	-	4J	-	-	-
Phenols	-	-	-	-	-
4,4'-DDT	-	-	-	NA	-
4,4'-DDE	-	-	-	NA	-
Chlordane	-	-	-	NA	-
Gamma-chlordane	NA	NA	NA	0.067	NA
Alpha-chlordane	NA	NA	NA	0.42	NA

- Material was analyzed for but not detected.
J Estimated value.
R Quality Control indicates data not useable.
NA Not analyzed.

SOUTHERN DITCH

Surface Water

The nature of the surface water contaminants found in the southern ditch is presented in Tables 5-36 and 5-37. These tables also include the results from the EPA December 1982 investigation when samples were collected at locations similar to SW-25, SW-28, SW-29, and SW-33, and designated as D-2, D-3, D-4, and D-5, respectively. For the purposes of this discussion, the surface water in sample SW-25 is considered the upstream control sample, since this sample includes the discharge from Zellwin Farms after it enters the ditch. The discharge from Zellwin Farms is a major source of water in the southern ditch. Other surface water collected at the boundary between Douglass Fertilizer and W. R. Grace (SW-43) is considered to represent the surface water quality leaving the Zellwood Groundwater Contamination Site.

As shown on Tables 5-36 and 5-37, the highest concentration of contaminants was found in samples collected downstream of the site boundary and behind an abandoned paint shop (SW-33). The furthest downstream sample (SW-36), approximately 1,400 feet from the site boundary, contained no contaminants of interest at significant concentrations. Therefore, it does not appear that even the contaminants contributed by off-site sources are migrating in the surface water of the southern ditch more than a few feet.

Sediment

Tables 5-38 and 5-39 present the concentrations of contaminants in sediment samples collected in the sourthern ditch. The results from the EPA December 1982 investigation are also included. These samples are designated as D-2S, D-3S, D-4S, and D-5S and were collected from locations similar to SS-25, SS-28, SS-29, and SS-33, respectively.

The southern ditch runs along the northern side of Jones Avenue at the site. Because of the proximity of the ditch to the road and the heavy traffic of cars and truck, the ditch sediment contained a wide variety of polynuclear aromatic hydrocarbons (PAHs). These compounds in the sediment samples may be related to the asphalt paved surfaces since the asphalt is composed of coal tar derivatives which contain numerous aromatic hydrocarbons. The concentrations of chromium, lead, and mercury in the sediments samples during the EPA December 1982 investigation are generally higher than the concentrations found during the RI. The exception is the sediment sample collected behind the abandoned paint shop (SS-33). An examination of the concentrations of both the inorganic and organic contaminants in the sediment samples collected during the RI indicates a significant increase in the concentrations of the contaminants of interest in the samples collected at and just downstream of the site boundary (SS-43 and SS-33).

TABLE 5-16
COMPARISON OF SELECTED CONTAMINANTS IN SURFACE WATER
SOUTHERN DITCH EAST OF DOUGLASS FERTILIZER
ZELLWOOD GROUNDWATER CONTAMINATION SITE
ORANGE COUNTY, FLORIDA

Parameter (ug/l)	SW-25/D-2		SW-26	SW-28/D-3		SW-29/D-4	
	2/83	12/82	2/83	2/83	12/82	2/83	12/82
Chromium	-	-	-	3.6	-	-	13
Lead	-	-	-	93	-	-	-
Mercury	-	-	-	-	-	-	-
Cyanide	R	9	R	R	4	R	2.2
Nitrate-Nitrite N	R	NA	R	R	NA	R	NA
Toluene	33	-	-	-	-	-	-
Phenols	-	-	-	-	-	-	-
4,4'-DDT	-	NA	-	-	NA	-	NA
4,4'-DDE	-	NA	-	-	NA	-	NA
4,4'-DDD	-	NA	-	-	NA	-	NA
Chlordane	-	NA	-	-	NA	-	NA
Gamma-Chlordane	NA	-	NA	NA	-	NA	0.04
Alpha-Chlordane	NA	-	NA	NA	-	NA	0.14

- Material was analyzed for but not detected.
J Estimated value.
NA Not analyzed.

TABLE 5-37
COMPARISON OF SELECTED CONTAMINANTS IN SURFACE WATER
SOUTHERN DITCH WEST OF DOUGLASS FERTILIZER
ZELLWOOD GROUNDWATER CONTAMINATION SITE
ORANGE COUNTY, FLORIDA

Parameter (mg/kg)	SW-30 2/85	SW-43 2/85	SW-33/D-5 2/85	SW-33/D-5 12/82	SW-36 2/85
Chromium	45	31	380	10	3.1
Lead	200J	100J	2,000J	-	-
Mercury	-	-	1.6	-	-
Cyanide	R	-	-	9.6	-
Nitrate-Nitrite N	R	R	R	NA	R
Toluene	-	-	-	-	-
Phenols	-	-	-	-	-
4,4'-DDT	-	-	-	NA	-
4,4'-DDE	0.07J	0.65	2.9	NA	-
4,4'-DDD	-	-	-	NA	-
Chlordane	0.4J	7.2	26	NA	-
Gamma-Chlordane	NA	NA	NA	0.48	NA
Alpha-Chlordane	NA	NA	NA	0.016	NA

- Material was analyzed for but not detected.
J Estimated value.
NA Not analyzed.

TABLE 5-18
COMPARISON OF SELECTED CONTAMINANTS IN SEDIMENT
SOUTHERN DITCH EAST OF DOUGLASS FERTILIZER
ZELLWOOD GROUNDWATER CONTAMINATION SITE
ORANGE COUNTY, FLORIDA

Parameter (ug/kg)	SS-1 (Control)	SS-25/D-25		SS-26	SS-28/D-35		SS-29/D-45	
	2/83	2/83	12/82	2/83	2/83	12/82	2/83	12/82
Chromium	-	9,900	22,000	30,000	30,000	36,000	16,000	43,000
Lead	4,000J	20,000J	80,000	60,000J	60,000J	80,000	40,000J	190,000
Mercury	-	-	100	340	410	200	-	800
Cyanide	-	-	120K	-	R	1,400	R	6,000
Nitrate-Nitrite N	-	R	NA	R	R	NA	R	NA
Toluene	-	-	-	-	-	-	-	-
Phenols	-	-	-	-	-	-	-	-
4,4'-DDT	20	R	NA	-	-	NA	-	NA
4,4'-DDE	240	210	NA	1,100	200J	NA	250	NA
4,4'-DDD	740C	72	NA	600J	100J	NA	60J	NA
Chlordane	-	R	NA	-	2,900N	NA	1,700N	NA
Gamma-chlordane	800	NA	-	NA	NA	-	NA	2,700
Alpha-chlordane	NA	NA	-	NA	NA	-	NA	2,800

- Material was analyzed for but not detected.
J Estimated value.
K Actual value is known to be less than value given.
R Quality control indicates data not useable.
NA Not analyzed.
N Presumptive evidence of presence of material.

TABLE 3-39
COMPARISON OF SELECTED CONTAMINANTS IN SEDIMENT
SOUTHERN DITCH WEST OF DOUGLASS FERTILIZER
ZELLWOOD GROUNDWATER CONTAMINATION SITE
ORANGE COUNTY, FLORIDA

Parameter (ug/kg)	SS-1 (Control) 2/83	SS-30 2/83	SS-43 2/83	SS-33/D-35 2/83	SS-33/D-35 12/82	SS-34 2/83	SS-35 2/83	SS-36 2/83
Chromium	-	20,000	56,000	83,000	50,000	1,700	19,000	9,900
Lead	4,000J	50,000J	200,000J	400,000J	83,000	5,000J	40,000J	20,000J
Mercury	-	95	1,700	2,400	210	-	280	-
Cyanide	-	-	R	R	4,100	R	-	-
Nitrate-Nitrite N	-	13,000	R	R	NA	R	R	R
Toluene	-	-	60J	-	-	-	-	-
Phenols	-	-	-	-	-	-	-	-
4,4'-DDT	20	40	-	-	NA	120N	-	-
4,4'-DDE	200	140N	760	3,300	NA	83	1,400	670
4,4'-DDD	700C	17	600J	66	NA	20	100J	140
Chlordane	-	130	13,000N	30,000N	NA	390N	15,000N	5,400N
Gamma-Chlordane	800	NA	NA	NA	2,600	NA	NA	NA
Alpha-Chlordane	NA	NA	NA	NA	2,800	NA	NA	NA

- Material was analyzed for but not detected.
J Estimated value.
R Quality control indicates data not useable.
NA Not analyzed.
N Presumptive evidence of presence of material.

MISCELLANEOUS DITCHES

Surface Water

The nature of the surface water contaminants found in the ditches south of Jones Avenue is presented in Table 5-40. The water from the Zellwin Farms facility south of Jones Avenue enters a ditch and flows west. This ditch flows a short distance before merging with a southerly flowing ditch.

The surface water in the Zellwin Farms drainage ditch (SW-27) contained low concentrations of lead, and toluene. The surface water sample (SW-39) collected upstream from SW-27 also contained acetone and trans-1,2-dichloroethene. The presence of these two organic contaminants in surface water at sample location SW-39, although not at SW-27, indicates that these organic contaminants are apparently the result of upstream contaminants in the ditch. It is possible that it is the result of run-off from the asphalt road.

Sediment

The nature of the sediment contaminants found in the ditches south of Jone Avenue is presented in Table 5-41. The sample (SS-39) containing the highest levels of most contaminants was collected upstream of the area where the Zellwin Farms drainage ditch joins the southerly flowing ditch. This sample contained concentrations of toluene and DDT and its derivatives higher than those in other samples collected both upstream at SS-38 and to the east at SS-27. The sediment sample collected at SS-39 also contained Trans-1,2-dichloroethene, methyl ethyl ketone, and 4-methyl phenol. Since the upstream samples does not show any of the contaminants, the little spur drainage ditch which runs north of the sampling location may be the source of the contaminants. A sand parking lot exists directly north of the short spur drainage dirch. Run-off from the parking area may be entering the ditch.

Since the contaminants in the miscellaneous ditches were not related to on-site activities, the extent of any contamination in them was not addressed in the RI.

PONDS

Most of the on-site ponds are related to the historic waste areas. The remaining ponds, the northwest pond, the nursery pond and the W.R. Grace fire pond, are discussed here.

TABLE 5-40
COMPARISON OF SELECTED CONTAMINANTS IN SURFACE WATER
DITCHES SOUTH OF JONES AVENUE
ZELLWOOD GROUNDWATER CONTAMINATION SITE
ORANGE COUNTY, FLORIDA

Parameter (ug/l)	SW-15 (Control) 2/85	SW-27 2/85	SW-39 2/85
Chromium	-	-	25
Lead	-	20J	30J
Mercury	-	-	-
Cyanide	-	-	R
Nitrate-Nitrite N	-	-	-
Toluene	-	4J	4J
Phenol	-	-	-
4,4'-DDT	-	-	-
4,4'-DDD	-	-	-
4,4'-DDE	-	-	-
Chlordane	-	-	-

- Material analyzed for but not detected.
J Estimated value.
R Data invalid.

TABLE 5-41
COMPARISON OF SELECTED CONTAMINANTS IN SEDIMENT
MISCELLANEOUS DITCHES
ZELLWOOD GROUNDWATER CONTAMINATION SITE
ORANGE COUNTY, FLORIDA

Parameter (ug/kg)	SS-1 (Control) 2/85	SS-38 2/85	SS-39 2/85	SS-27 2/85
Chromium	-	29,000	6,200	-
Lead	4,000J	-	-	-
Mercury	-	-	-	-
Cyanide	-	-	-	-
Nitrate-Nitrite N	-	R	R	R
Toluene	-	-	600J	-
Phenols	-	-	-	-
4,4'-DDE	240	5	1,100	32
4,4'-DDT	20	R	1,300	6
4,4'-DDD	740C	3J	930	13
Chlordane	-	R	R	-
Gamma chlordane	800	NA	NA	NA

- Material analyzed for but not detected.
J Estimated value.
R Data invalid.
N Presumptive evidence of presence of material.
C Confirmed by GC/MS.
NA Not analyzed.

Surface Water

The nature of the surface water contaminants found in the off-site ponds and W.R. Grace fire pond is presented in Table 5-42. As shown, the off-site ponds located northwest and northeast of the site and at the W.R. Grace facility contain no concentrations of the contaminants of interest above the laboratory detection limits.

Sediment

The nature of the sediment found in the off-site ponds is presented in Table 5-43. No sediment samples were collected from the W.R. Grace fire pond because it was lined with concrete. Both off-site ponds contain contaminants of interest at very low concentrations unrelated to site activities.

SURFACE WATER AND SEDIMENT SUMMARY

The surface water and sediment investigation included the collection and analysis of water and sediment samples from several drainage ditches and ponds. There were three main ditches; northern, middle and southern, as well as four on-site ponds. The major source of the water in the ditches is derived from run-off of rainfall; however, the southern ditch does receive a direct discharge from the Zellwin Farms Company. There were several potential sources of contamination identified as a result of the sample analysis. The large pond in the southwest corner of the abandoned drum storage area appears to have contributed contaminants to the northern ditch.

The water and sediment samples collected on the western end of the middle ditch exhibit elevated concentrations of lead and and chromium, as well as above background levels of iron, aluminum and zinc. These samples were collected very near the location of the temporary sludge storage area. The ditch is at a lower elevation than the sludge storage area. The ditch is at a lower elevation than the sludge storage area and runoff or groundwater seepage into the ditch is plausible.

Finally the southern ditch samples contained may polynuclear aromatic hydrocarbons, apparently associated with run-off from the paved asphalt surfaces at the Zellwin Farms Company as well as from Jones Avenue.

GROUNDWATER INVESTIGATION

The groundwater investigation portion of the project can be subdivided into several portions. EPA installed seventeen new monitor wells: seven in the upper part of the shallow aquifer; seven in the lower part of the

TABLE 5-42
COMPARISON OF SELECTED CONTAMINANTS IN SURFACE WATER
MISCELLANEOUS PONDS
ZELLWOOD GROUNDWATER CONTAMINATION SITE
ORANGE COUNTY, FLORIDA

Parameter (ug/l)	SW-15 NW Pond 2/85	SW-8 Nursery Pond 2/85	SW-32 W.R. Grace Fire Pond 2/85
Chromium	-	-	-
Lead	-	-	-
Mercury	-	-	-
Cyanide	-	-	R
Nitrate-Nitrite N	-	-	R
Toluene	-	-	-
Phenols	-	-	-
4,4'-DDT	-	-	-
4,4'-DDE	-	-	-
4,4'-DDD	-	-	-
Chlordane	-	-	-

- Material analyzed for but not detected.
R Data invalid.

TABLE 5-43
COMPARISON OF SELECTED CONTAMINANTS IN SEDIMENT
MISCELLANEOUS PONDS
ZELLWOOD GROUNDWATER CONTAMINATION SITE
ORANGE COUNTY, FLORIDA

Parameter (ug/kg)	SS-15 NW Pond 2/85	SS-8 Nursery Pond 2/85
Chromium	-	-
Lead	9,000J	-J
Mercury	-	-
Cyanide	-	-
Nitrate-Nitrite N	-	-
Toluene	-	-
Phenols	-	-
4,4'-DDT	9.6N	-
4,4'-DDD	53N	-
4,4'-DDE	120N	10
Chlordane	-	-
Gamma-Chlordane	NA	30J
Alpha - Chlordane	NA	30J

- Material analyzed for but not detected.
J Estimated value.
N Presumptive evidence of presence of material.
NA Not analyzed.

shallow aquifer; and three in the Floridan aquifer. In addition, six previously installed shallow aquifer monitor wells, various private wellls and several temporary wellpoints were sampled. The groundwater sampling locations can be seen on Figure A-12.

Surficial Aquifer

The nature of the groundwater contaminants found in the surficial aquifer is presented in Tables 4-24, 4-25, and 4-26. The tables include the maximum concentration of each contaminant found in samples collected from either the upper of lower well at each location. The maximum concentration was used because the contaminants of interest were distributed throughout the aquifer; and, if groundwater recovery is part of the selected alternative, groundwater from the complete thickness of the aquifer would need to be removed.

The presence of cadmium in the I985 groundwater samples from wells at the southern boundary and southwest of the site (6SA/SB, MW-3A/B, and MW-1A/B) of Florida and to Southern Liquid Fertilizer/Douglass Fertilizer and Chemical Company. This is substatiated by the presence of cadmium found in the surface water samples collected from the large pond on fertilizer companies' property in 1981 and 1982, and the cadmium found in the surface water samples collected from the Drum Service Company of Florida ponds in 1980.

The presence of arsenic in the groundwater samples collected from the southern boundary of the site (MW-1A/B) appears to also be related to past operations at the fertilizer companies or to past or present operations at Drum Service Company of Florida. This is based on the presence of arsenic in the groundwater beneath the two Drum Service Company of Florida covered ponds. Aresenic was also present in lower concentrations in the shallow groundwater beneath the abandoned drum area and the temporary sludge storage area.

There was also a significant level of cyanide (200 mg/l) in the groundwater samples collected southwest of the site (6SA/SB0 and at the southern site boundary (MW-1A/B). The concentration in the groundwater in these two areas were an order of magnitude greater than in any other samples collected during the RI. Since many soil and surface water samples were considered not useable because of quality control, the source of the cyanide in the groundwater cannot be determined. However, cyanide was found in the shallow groundwater beneath both of the covered ponds used by Drum Service Company of Florida in similar concentrations to those found in the groundwater at the upgradient well 3SA/SB.

The other trace metals of interest found in groundwater samples collected downgradient or on-site are chromium, lead, and mercury. The presence of mercury has been detected in past studies in surface water samples collected from the Southern Liquid and Fertilizer pond in 1981, in surface water samples collected in 1980 from the ponds used by Drum Service Company,

TABLE 4-24
MAXIMUM CONCENTRATIONS OF SELECTED CONTAMINANTS IN GROUNDWATER
SURFICIAL AQUIFER DOWNGRADIENT OF LOCATION 1
ZELLWOOD GROUNDWATER CONTAMINATION SITE
ORANGE COUNTY, FLORIDA

	Upgradient	Downgradient				
Parameter (ug/l)	1SA/SB 5/85	2SA/SB 5/85	7SA/SB 5/85	MW-1A/B 5/85	MW-3A/B 5/85	6SA/SB 5/85
Chromium	22	44	102	18	4	92
Lead	-	-	440	286	110	290
Mercury	-	-	1J	-	0.4J	0.8J
Cyanide	-	20,000J	-	200,000J	-	200,000J
Nitrate-Nitrite N	22,000	18,000	23,000	1,600	3,800	214,000
Toluene	5J	5J	5J	5J	-	-
Phenols	-	10J	10J	-	-	-
4,4'-DDT	-	-	-	-	-	-
4,4'-DDE	-	-	-	.09	-	-
4,4'-DDD	-	-	-	-	-	-
Chlordane	-	-	-	-	-	-
Ammonia	-	330	11,000	770	18,000	328,000
Total Phosphorus	320	69	78	730	270	15,000
Cadmium	-	-	-	24	11	10
Arsenic	-	-	-	46	-	-

- Material was analyzed for but not detected.
J Estimated value.

TABLE 4-25
MAXIMUM CONCENTRATIONS OF SELECTED CONTAMINANTS IN GROUNDWATER
SURFICIAL AQUIFER DOWNGRADIENT OF LOCATION 4
ZELLWOOD GROUNDWATER CONTAMINATION SITE
ORANGE COUNTY, FLORIDA

Parameter (ug/l)	Upgradient 4SA/SB 5/85	Downgradient 7SA/SB 5/85
Chromium	13	102
Lead	180	440
Mercury	-	13
Cyanide	-	-
Nitrate-Nitrite N	300	23,000
Toluene	-	5J
Phenols	10J	10J
4,4'-DDT	-	-
4,4'-DDE	-	-
4,4'-DDD	-	-
Chlordane	-	-
Ammonia	160	11,000
Total Phosphorus	2,800	78
Cadmium	-	-
Arsenic	-	-

\- Material was analyzed for but not detected.
J Estimated value.

TABLE 4-26
MAXIMUM CONCENTRATIONS OF SELECTED CONTAMINANTS IN GROUNDWATER
SURFICIAL AQUIFER DOWNGRADIENT OF LOCATION 3
ZELLWOOD GROUNDWATER CONTAMINATION SITE
ORANGE COUNTY, FLORIDA

Parameter (ug/l)	Upgradient 3SA/SB 5/85	Downgradient 5SA/SB 5/85	Downgradient 6SA/SB 5/85
Chromium	17	180	92
Lead	-	-	290
Mercury	-	-	0.8J
Cyanide	20,000J	-	200,000J
Nitrate-Nitrite N	7,000	300	214,000
Toluene	5.1	-	-
Phenols	10J	-	-
4,4'-DDT	-	-	-
4,4'-DDE	-	-	-
4,4'-DDD	-	-	-
Chlordane	-	-	-
Ammonia	120	-	328,000
Total Phosphorus	330	110	15,000
Cadmium	-	-	10
Arsenic	-	-	-

- Material was analyzed for but not detected.

and in shallow groundwater samples collected downgradient of the abandoned drum area in 1981. During the RI, mercury was found in significant concentrations in the abandoned drum area in the samples collected from both the surface and subsurface soils. Mercury was also found in shallow groundwater samples collected in 1985 beneath the abandoned drum area, temporary sludge area and both covered ponds as well as the groundwater southwest (MW-3A/B and 6SA/B) and west of the site (7SA/B).

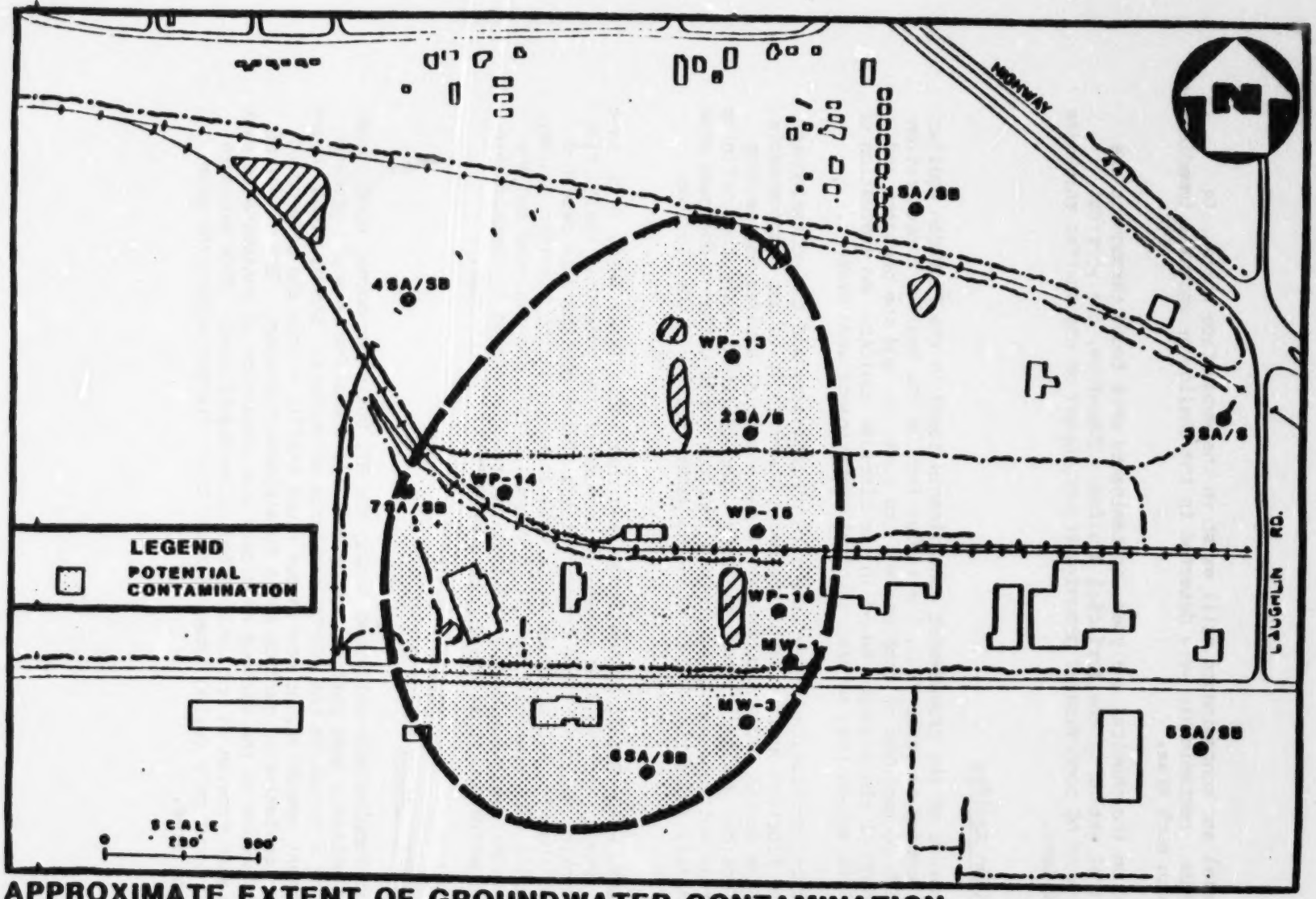
The presence of chromium and lead was found throughout the site. The highest concentrations of lead (an order of magnitude greater) found during the RI were in the samples collected from the sediment of the large pond in abandoned drum area. Chromium was found in the greatest concentration in the soil samples from the abandoned drum area and in the sediment samples from the fertilizer companies' ponds. Chromium was also found in the groundwater concentrations (7SA/SB, 5SA/SB, 6SA/SB) as well as in the shallow groundwater drum area. Lead was found in the groundwater samples collected at the southern boundary of the site (MW-1A/B) as well as west and southwest of the site (7SA/SB, MW-3A/B, and 6SA/SB) and beneath the abandoned drum area and the two covered ponds.

Many organics were found in the groundwater on and downgradient of the site. The presence and concentration of both purgeable and extractable organics is greatest in the groundwater samples collected beneath the Drum Service Company's former perculation ponds. Many of the organics found in groundwater samples beneath and downgradient of the site are contaminants that are present in either the subsurface soil samples from the abandoned drum area or in the subsurface soil samples from the covered ponds. This indicates that these contaminants may still be leaching and migrating to the surficial aquifer. Some of these contaminants have migrated at least as far as the southern boundary of the site (MW-1A/B).

The groundwater samples containing the highest overall level of contamination were collected southwest of the site from monitor well 6SA/SB. The concentrations of nitrate-nitrite, ammonia, and phosphorus were all an order of magnitude greater than in other samples. These high concentrations are associated with fertilizer production and are apparently coming from the old Southern Liquid Fertilizer/Douglass Fertilizer ponds or past operations at that facility.

Volume of Contaminated Groundwater in Surficial Aquifer

The distribution of the contaminants in the surficial aquifer beneath and downgradient of the site suggests that groundwater contaminants have migrated to at least the location of well 6SA/SB. Using the chemical analyses and travel times described above, an estimate was made of the potential horizontal extent of groundwater contamination attributable to the site. Figure 4-14 shows the region approximating the areal extent of groundwater contamination in the surficial aquifer. The groundwater beneath abandoned drum area and temporary sludge storage is included in the region because these areas received an unknown quantity of waste



APPROXIMATE EXTENT OF GROUNDWATER CONTAMINATION
SURFICIAL AQUIFER
ZELLWOOD GROUNDWATER CONTAMINATION SITE
ORANGE COUNTY, FLORIDA

FIGURE 4-14

material and contaminants still exist in the subsurface soils. In addition, contaminants were detected in the shallow groundwater immediately beneath each area.

Based on the chemical analyses, contaminants were found throughout the vertical extent of the surficial aquifer. Therefore, the vertical estimates of contaminated groundwater were based on the aquifer thickness of 40 feet.

Floridan Aquifer

The nature of the groundwater contaminants found in the Floridan aquifer is presented in Table 4-31. The tables include the maximum concentration of each contaminant of interest and its location, and the presence and location of the organics found in the Floridan aquifer. An evaluation of the data showed that several critical contaminants were present.

A direct correlation between the site contaminants and the contaminants in the Floridan aquifer cannot be made; however, it is not inconceivable that the contaminated groundwater in the surficial aquifer is reaching the Floridan aquifer through sinkholes, through areas where the confining layer is not continuous, or through improper construction techniques used to install industrial and/or drinking water wells into the Floridan aquifer.

The EPA, Water Supply Branch, requested that wells IW-2, IW-4, IW-5, IW-6, IW-8, PW-10, and PW-12 be resampled because of the potential health risk of drinking water with the concentrations of the contaminants detected during the RI. All of these wells were screened in the Floridan Aquifer. The wells were resampled by EPA in December, 1985 and analyzed and the well owners were advised by EPA that the results showed no contaminants at concentrations that would pose a significant health risk.

Air Investigation

No air samples were collected during the RI, but under normal conditions, it is unlikely that particulate or volatile contaminants would present much of a threat to the nearby residents or workers. Strong winds, heavy equipment operation, or continuous truck traffic within the site could expose contaminated surface soils to airborne transport. The extent of the exposure to the various chemicals via inhalation of contaminated dust from wind erosion is not anticipated to be significant. This exposure would occur only during times of heavy truck traffic within the drum storage ares.

TABLE 4-31
MAXIMUM CONCENTRATION OF SELECTED CONTAMINANTS IN GROUNDWATER
FLORIDAN AQUIFER 1985
ZELLWOOD GROUNDWATER CONTAMINATION SITE
ORANGE COUNTY, FLORIDA

Parameter	Concentration (ug/l)	Location(s)
Chromium	96	1D
Lead	50	1D
Mercury	2.2	IW-2
Cyanide	-	-
Nitrate-Nitrite N	200	1D
Toluene	5J	1D, 7D
Phenol	24	1D
4,4'-DDT	-	-
4,4'-DDE	-	-
4,4'-DDD	-	-
Ammonia	2,100	IW-6
Phosphorus	1,500	IW-6
Chloride	330,000	IW-6
Iron	190,000	3D
Silver	5J	IW-2

SUBSURFACE INVESTIGATION

Test Boring Program

A test boring program was instituted at the Zellwood Groundwater Contamination Site to characterize the site geologically and to determine intervals for well screens prior to well installation. A test borehole was advanced at each of the seven monitor well locations. Except for location number two, all test borings were advanced 200 feet or to the top of the Floridan aquifer whichever was less. The confining Hawthorn Formation was not penetrated at location number two because of the suspected levels of contamination in this area.

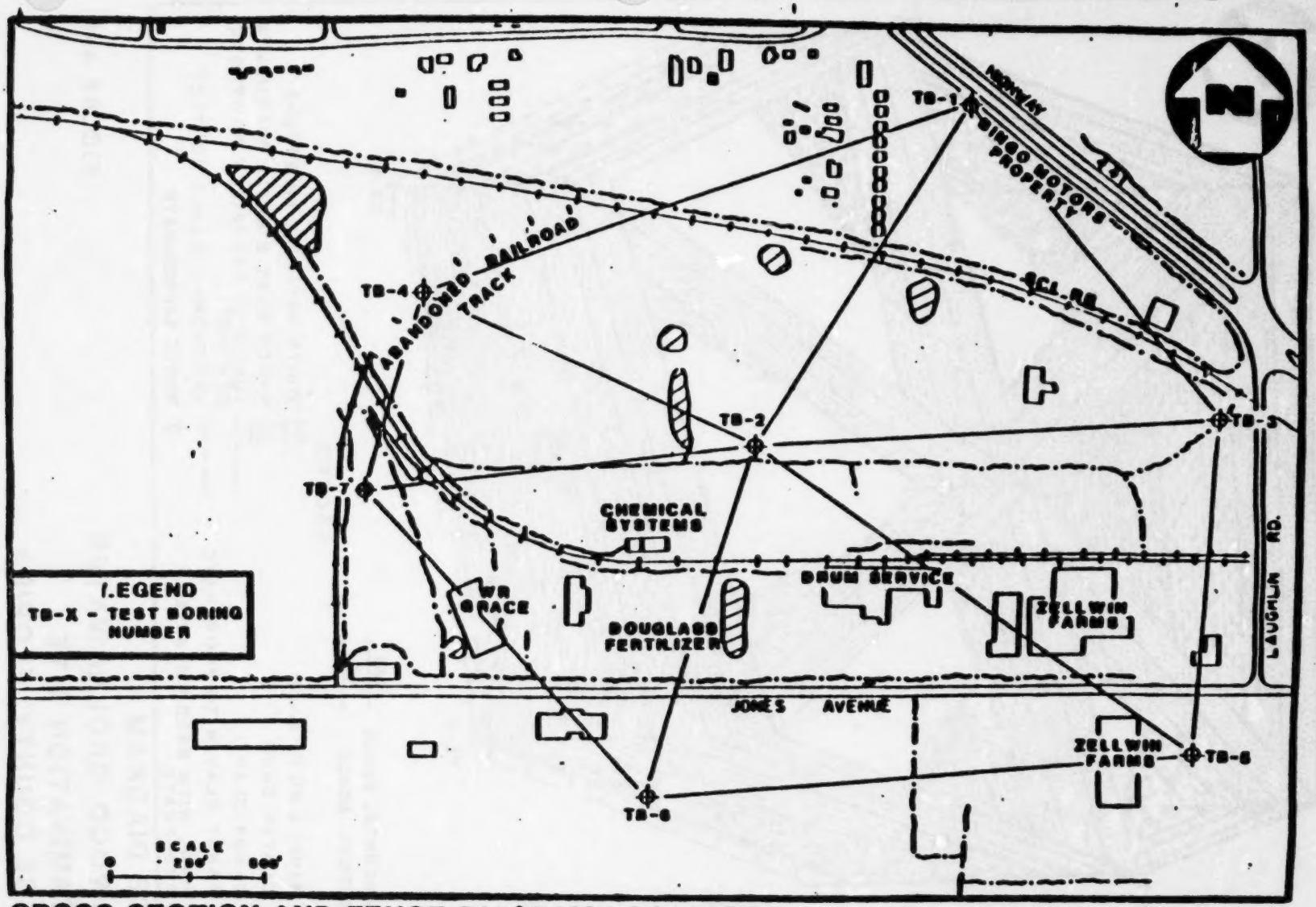
Well logs were used to develop cross sections to illustrate the geology on and around the site. Figure 4-3 shows the location of cross sections. Figure 4-5 shows a fence diagram encompassing the site that was developed using wells logs from all test boring locations.

ROUTES OF TRANSPORT AND POTENTIAL RECEPTORS

Surface Water and Sediment/Soil

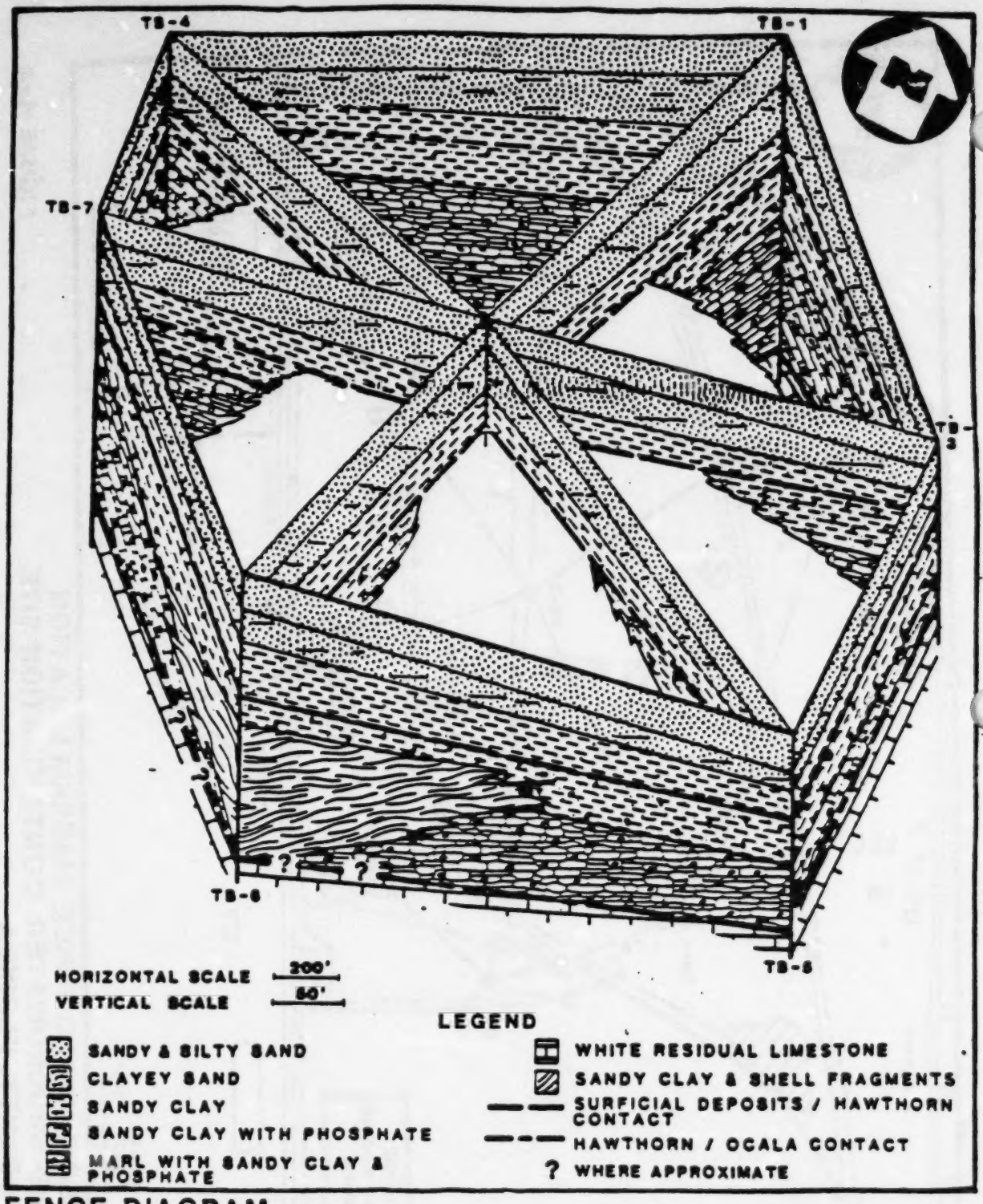
Surface water features at the site include several ponds and three distinctive drainage pathways referred to as the northern, middle, and southern ditches. Surface water run-off at the site is either confined in the ponds or is channeled to one of the ditches. Although site drainage is to the west and ultimately to the south toward the muck farms and Lake Apopka, the data from the RI showed little migration of surface water contaminants off-site. Unless there has been a heavy incidence of rain, the northern and middle ditches are usually dry containing only isolated areas of stagnant water. The southern ditch contains a fairly constant flow of water, since it receives a direct discharge and run-off from the Zellwin Farms large paved parking lot.

Several inorganic and organic constituents were detected in both the surface water and sediment samples. The inorganic constituents include arsenic, zinc, and mercury, which was detected in sediment samples from the northern ditch; mercury was also identified in sediment samples from the southern ditch. Many extractable organic compounds associated with coal tar derivatives were identified in samples from the southern ditch.



CROSS SECTION AND FENCE DIAGRAM LOCATION
ZELLWOOD GROUNDWATER CONTAMINATION SITE
ORANGE COUNTY, FLORIDA

FIGURE 4-3



FENCE DIAGRAM
ZELLWOOD GROUNDWATER CONTAMINATION SITE
ORANGE COUNTY, FLORIDA

FIGURE 4-5

Six of these compounds were also detected in the southern fork of the northern ditch. It is possible that the heavily paved area around the Zellwin Farms Company packaging house or the Jones Avenue asphalt road are contributing these contaminants via surface water run-off. The water samples from the ditches also contained numerous inorganic and organic constituents; DDE was detected in all three ditches.

The samples from the two ponds located in the abandoned drum storage area exhibited the highest concentrations for several organic compounds including toluene.

Surface soil samples collected from the drum storage area contained many inorganic constituents including chromium, lead, and mercury. Several organic compounds associated with wood preserving chemicals were detected in the surface soil sample collected along the northern end of the site on the southside of the Seaboard Coastline Railroad tracks. These compounds may be leaching out of the railroad ties into the surrounding soils.

Groundwater

The movement of contaminants through the groundwater (surficial and Floridan aquifers) is one of the major transport routes of concern at the Zellwood Groundwater Contamination Site. Groundwater flow rates, direction, and hydrogeologic parameters affecting contaminant migration were defined. Several heavy metals and a few organic compounds were detected in the groundwater samples collected from the surficial aquifer monitor wells. Chromium, cyanide, nitrate, and mercury are among the inorganic constituents detected; toluene, chlordane, and trichloroethene are examples of some organic compounds identified. Although a direct exposure to the contaminants in drinking water wells is unlikely, human and biotic receptors could come in contact with the chemicals where the groundwater discharges to surface waters or as a result of shallow excavation downgradient of the site. The Floridan aquifer has shown no contaminants which could be related to site activities.

Air

Under normal conditions, it is unlikely that particulate or volatile contaminants would present much of a threat to the nearby residents or workers. However, strong winds, heavy equipment operation, or continuous truck traffic within the site could expose contaminated surface soils to airborne transport. Harmful acute exposures to any of the contaminants is very unlikely. For chronic exposures, there would have to be a constant disturbance of the soil over a long time period. The changes of this occurring are likewise very minimal.

SECTION V
REMEDIAL ALTERNATIVES

SCREENING OF REMEDIAL TECHNOLOGIES

Numerous technologies are available for use at the Zellwood Groundwater Contamintation Site. Although many are applicable, it is apparent that a number of technologies can be removed from further consideration based on the information obtained about the site from the remedial investigation (RI).

Screening began during the RI as information on the site conditions was obtained, and a list of preliminary, applicable technolgies was developed. This list comprises actions that address the potential site problems and pathways of contamination identified during the RI:

- No action
- No action - monitoring
- Alternate water supply
- Capping
- Regrading and revegetation
- Groundwater barriers
- Groundwater recovery
- Sediment and surface water removal
- Excavation
- Waste pile removal
- In-situ treatment
- Surface water and groundwater treatment
- Incineration
- Disposal technologies

Each technology has been reviewed in accordance with the following three criteria:

- Effectiveness
- Implementability
- Cost

During the initial screening, the investigation team and other personnel, with experience in various applicable disciplines, reviewed and evaluated the results and conclusions of the RI. The technologies identified during the RI, as well as technologies encompassing treatment or disposal which

were thought to be of importance, were discussed and evaluated. In some cases, there are several technologies that are similar to each other, such as the various technologies used for an alternate water supply. In these cases, an evaluation was performed to determine which technology was most appropriate for the Zellwood Groundwater Contamination Site.

Tables 2-1 through 2-6 contain the technologies that were initially screened. These tables also contain the reasons why the various technologies either passes or failed the initial screening. The technologies that passed the screening were then grouped into a series of nine remedial alternatives. The nine remedial alternatives were developed in accordance with the National Contingency Plan exhortation to develop a series of alternatives that show:

1) alternatives for treatment or disposal at an off-site facility as appropriate;

2) alternatives that attain applicable or relevant and appropriate Federal public health and environmental requirements;

3) alternatives that exceed applicable or relevant and appropriate Federal public health and environmental requirements;

4) alternatives that do not attain applicable or relevant and appropriate Federal public health and environmental requirements but will reduce the likelihood of present or future threat from the hazardous substance and that provide significant protection to public health and welfare and the environment. This must include an alternative provided by the applicable or relevant and appropriate requirements;

5) No action alternative.

The remainder of the section will discuss in detail the nine alternatives.

ALTERNATIVE 1 - <u>No Action - Monitoring</u>

If this alternative were implemented, a long term groundwater monitoring program would be established to provide information on contaminant movement and exposure to humans and the environment. The monitoring would be performed on a quarterly basis for the first three years, at which time the program would be re-evaluated.

TABLE 2-1
TECHNICAL SCREENING
ALTERNATE WATER SUPPLY TECHNOLOGY
ZELLWOOD GROUNDWATER CONTAMINATION SITE
ORANGE COUNTY, FLORIDA

Alternate Water Supply Technology	Retained for Further Evaluation	Comments
Municipal Water Supply Extension	Yes	Most complete and reliable; no monitoring required
Bottled Water	Yes	Short-term solution
Individual Treatment Units	No	Requires extensive monitoring and maintenance

TABLE 2-2
TECHNICAL SCREENING
CAPPING TECHNOLOGY
ZELLWOOD GROUNDWATER CONTAMINATION SITE
ORANGE COUNTY, FLORIDA

Surface Capping Technology	Retained for Further Evaluation	Comments
Clay	Yes	Used extensively
Synthetic Membrane	Yes	Used extensively
Concrete and Asphalt	No	Susceptible to cracking
Soil Mixtures	No	Limited experience

TABLE 2-3
TECHNICAL SCREENING
GROUNDWATER BARRIERS
ZELLWOOD GROUNDWATER CONTAMINATION SITE
ORANGE COUNTY, FLORIDA

Groundwater Barrier Technology	Retained for Further Evaluation	Comments
Slurry Wall	Yes	Demonstrated performance
Sheet Piling	No	High cost *
Grout Curtain	No	Potential for gaps to occur during curtain placement

* in comparison to the slurry wall technology

TABLE 2-4
TECHNICAL SCREENING
SURFACE WATER AND GROUNDWATER TREATMENT TECHNOLOGIES
ZELLWOOD GROUNDWATER CONTAMINATION SITE
ORANGE COUNTY, FLORIDA

Water Treatment Technology	Retained for Further Evaluation	Comments
Flow Equalization	Yes	Promotes process stability
Precipitation, Flocculation, and Sedimentation	Yes	Metals and inorganics removal
Filtration	Yes	Suspended solids removal
Carbon Adsorption	Yes	Organic chemical removal
Ion Exchange	Yes	Nitrate removal
Chemical Oxidation	Yes	Cyanide removal
Activated Sludge	Yes	Organics, metals, and nitrogen removal
Anaerobic contact/anaerobic filter	Yes	Organics, metals, and nitrogen removal
Oxidation ditch	Yes	Organics, metals, and nitrogen removal

TABLE 2-5
TECHNICAL SCREENING
INCINERATION TECHNOLOGY
ZELLWOOD GROUNDWATER CONTAMINATION SITE
ORANGE COUNTY, FLORIDA

Incineration Technology	Retained for Further Consideration	Comment
Fluidized Bed	No	Limited experience
Multiple Hearth	No	Not appropriate for wastes requiring high temperatures
Cement Kiln	No	Not appropriate for hazardous waste
Lime Kiln	No	Not appropriate for hazardous waste
Rotary Kiln	Yes	Applicable for variable liquid and solid wastes

TABLE 2-6
POTENTIAL REMEDIAL TECHNOLOGIES
ZELLWOOD GROUNDWATER CONTAMINATION SITE
ORANGE COUNTY, FLORIDA

Technology	Passed Initial Screening	Passed Further Screening
Site Remediation:		
No Action Technologies	No	-
Monitoring	Yes	Yes
Alternate Water Supply (Extension of Municipal Water Lines and Bottled Water)	Yes	No
Capping (Synthetic and Clay)	Yes	Yes
Regrading and Revegetation	No*	-
Groundwater Barriers	Yes	No
Groundwater Recovery	Yes	Yes
Sediment and Surface Water Removal	Yes	Yes
Excavation	Yes	Yes
Waste Pile Removal	Yes	Yes
In-situ Treatment (Soil Flushing)	Yes	Yes
Treatment of Removed Materials:		
Surface Water and Groundwater Treatment	Yes	Yes
Incineration (Rotary Kiln)	Yes	Yes
Disposal of Removed Materials:		
Offsite Disposal	Yes	Yes
Onsite Disposal	Yes	No

* Ancillary to primary technologies

Effectiveness

Implementation of this alternative would not reduce or eliminate any of the impacts resulting from the site contaminants. It would be effective in providing information about the movement of the contaminants, so that future remedial actions could be taken if necessary. The monitoring system should last the effective life necessary to complete the objectives of this alternative.

The major safety risk involved in implementing this alternative would be to the workers constructing the two new groundwater monitor wells. Continuous monitoring during construction would prevent exposure to hazardous substances. There should be no threat to any private residents or workers at or near the site.

In addition to the sampling personnel under the no action alternative, there would be workers involved in the construction of two new groundwater monitor wells. These remedial personnel could be faced with possible deleterious effects as a result of inhalation of volatile contaminants. However, if continuous air monitoring activities were performed, risks associated with the implementation of this alternative could be controlled. Based on previous experience with these activities, the duration of exposures would be very short and exposure levels could be adequately controlled to below acceptable levels by existing, readily available technologies. The excess risk of cancer, chronic health effects, and acute health effects could be minimal and therefore not a factor in the implementation of monitoring activities.

For the purpose of evaluating public health risks from the release of hazardous substances from the site, it was necessary to select certain chemicals for evaluation. These indicator chemicals are those that are considered to contribute most significantly to the risk of endangering human health. The procedure used to select the indicator chemicals was outline in the draft guidance document prepared for the EPA, Superfund Public Health Evaluation Manual (ICF, 1985). The maximum concentration of each of the indicator chemicals detected in various sampling media during the RI is shown on Table 4-1.

Groundwater is the principal environmental transport medium for contaminants originating from the Zellwood Groundwater Contamination Site. During the RI, high levels of contaminants were found in the surficial aquifer both on- and off-site. The contaminants were detected in samples taken from permanent groundwater monitor wells and temporary well points. The risk associated with the site is dependent on both the hazard of the specific chemicals and the potential for exposure. Presently, there are no known points of potential human exposure through ingestion of contaminated groundwater. The surficial aquifer flows to the southwest and eventually discharges to Lake Apopka or to the canals which flow into Lake Apopka. There are no known wells finished in the surficial aquifer between the site and Lake Apopka.

There are many possible scenarios which could provide a point of exposure for humans to the contaminated groundwater. For the purposes of this investigation and to illustrate the levels of contaminants found during the RI, a "worst case" situation is developed below. The worst case would be for a well, utilized for potable water, to be set in the most contaminated area of the surficial aquifer. Based on the concentrations shown on Table 4-1, the cancer risk associated with drinking two liters of water per day for seventy years if approximately 6×10^{-1}. This cancer risk is based entirely on the high levels of arsenic found in the groundwater collected from shallow well points located on-site. It should be noted that because groundwater samples are not filtered, the concentration detected may not represent the concentration which is actually moving in the groundwater.

Another possible worst case scenario could occur if excavation were to be performed downgradient of the site. Since the water table is only 4 to 6 feet below the ground surface, excavation could expose contaminated groundwater. Using the maximum concentration of cyanide [200 milligrams per liter (mg/l)] found in the groundwater at monitor well location 6, a quantity of approximately 4.8 ounces could be lethal. This quantity was estimated based on the LDL_o for cyanide at 2857 micrograms per kilogram (ug/kg) (Sax, 1981) and a 10 kg (child) body weight. It is not impossible for a child to fall into a samll body of water formed during excavation and for several ounces of water to be ingested.

Surface water is another principal medium for humans to be exposed to at the site. Surface water was present in both ponds and ditches. Since it is highly unlikely that any of surface water bodies will be used for a life-time drinking water source, it is more appropriate to look at surface water as providing an accidental exposure and therefore acute toxicity. Based on surface water samples obtained during the RI, there are no known chemicals present at sufficient concentrations to cause acute toxicity.

The surface soil, sediment and waste piles provide an additional contaminated media for potential exposure on-site. Since the site is accessible to humans, contact is possible. In order to estimate a potential risk for ingestion of soil, assumptions were made based on studies performed by the Centers for Disease Control (CDC). A child could ingest approximately 0.1 to 1 gram of soil per day for about five years. Since the most contaminated soil areas exist in the abandoned drum area, and accessibility is easily accomplished, ingestion of 0.1 gram per day and a 20 percent availability factor were used in the risk calculation. The risks are summarized on Table 4-2. This table represents a worst case analysis and assumes a shield would ingest 0.1 gram of soil each day for five years and that 20 percent of the time the soil would be from the area on-site found during the RI to be the most ontaminated. As shown on Table 4-2, arsenic has the highest risk.

The remaining residual risk associated with the no-action alternative is the potential for a change in the existing levels of risk, due to changes in the concentrations of chemicals that the receptors are presently experiencing. Since the groundwater is to only media expected to have

any potential for migration, the proposed monitoring program would provide information regarding changes in contaminant concentration.

The no action alternative would provide no protection to the regional ecology from the conditions as they presently exist. The groundwater will eventually discharge into Lake Apopka or the canals which flow into Lake Apopka. The approximate volume of Lake Apopka is 5 billion gallons. This would create a dilution factor of about 2.5 million to 1. Using the maximum concentration of cyanide observed in the groundwater and assuming it is uniformly distributed throughtout the full extent of the aquifer at the same concentration, the concentration of cyanide after dilution in Lake Apopka (under worst case conditions) could not exceed 0.02 nanogram/liter (ng/l). There is a possibility for environmental receptor toxicity to occur if the receptor were to come in contact with undiluted concentrations of a contaminant, but this is not considered likely because of dispersion and advection of the groundwater contaminants over the large area.

Implementability

This alternative could be implemented quickly with little difficulty. Two new groundwater monitor wells could be installed in approximately one week at the downgradient location. Existing monitor wells or private wells could be used for the other monitoring locations.

Implementing this alternative would require workers skilled in taking representive groundwater samples from monitor and existing private wells. Such workers are readily available. Historically, monitoring has proven to be a reliable method for determining concentrations of contaminants in groundwater. Operations and maintenance considerations would include inspection of the wells and quarterly sampling and analyses of the groundwater.

Implementing the monitoring portion of the no action alternative should create no negative environmental impacts. Sampling of groundwater monitor wells and private and industrial water supply wells would be the only actions. Generally, environmental sampling of this nature is an unobtrusive exercise which, if executed conscientiously, should not pose a threat to the regional environment.

This alternative could be implemented without having to obtain any permits or other regulatory approvals; however, it would not satisfy any applicable or relevant and appropriate requirements. It would be necessary to make arrangements for an agency to conduct the sampling, analysis, and interpretation of data.

Implementation of this alternative would provide responsible agencies and the public with information on the location, magnitude, and potential impact of the contamination from the Zellwood Groundwater Contamination Site. It would not correct any problems at the site and consequently would not address any concerns which the agencies or the public might have regarding the site.

Land use restrictions would also be necessary to prevent well installation in the surficial aquifer downgradient of the site.

Cost

Capital costs for constructing two groundwater monitor wells would be $12,000. Operation and maintenance costs were included with this alternative to inspect the monitor wells and provide quarterly groundwater sampling and analyses. The number of groundwater samples taken each year was assumed to remain constant at 64 and monitoring was assumed to occur annually for thirty years. For the first three years, the groundwater would be analyzed for the hazardous substance list of contaminants, and then the program would be re-evaluated. For purposes of costing, it was also assumed that analyses would cost $500 per sample for all samples collected after the third year. This would result in an estimated annual operation and maintenance cost for the first three year of $102,720 and for years four through thirty of $48,960.

ALTERNATIVE 2 - Monitoring and Waste Pile Removal

If this alternative were implemented, a monitoring program for groundwater would be established in addition to the removal of the waste piles located in the northern section of the abandoned drum area.

The evaluation of the monitoring program applies to this alternative as well. This section only presents the evaluation of the removal of the waste piles.

Effectiveness

If the waste area were removed, no maintenance would be needed, since the source of contamination would be eliminated.

The residual risk of this alternative would be almost identical to the residual risk of the previous alternative. The only change would be that the two waste areas would no longer be an exposure point or provide a future source of contaminants to groundwater or surface water.

Some decrease in environmental impact would result from removing the waste piles. The analyses of the soil/waste from these two areas indicate high levels of various contaminants, and the surrounding area showed little or no vegetation.

Implementability

The major risks added to this alternative would be those incurred by handling and transporting contaminated soil from the waste piles. Monitoring of these area was performed during the RI with an HNU and no readings above background were recorded. However, high concentrations of many organics and many inorganics, such as mercury, would suggest that precautions should be taken. The period of exposure would be short, which would tend to decrease the risks of chronic health effects. Any risks associated with exposure should be controlled by readily available and proven control technolgies.

Nearby off-site public receptors could be exposed during transportation of wastes to an off-site facility. Since it should take only one truck to haul the wastes, no significant risk should be incurred.

Impacts on local and regional environmental receptors during implementation of this alternative would be negligible if good work practices are employed.

All previously discussed institutional requirements would apply to this alternative. In addition, the RCRA regulations set forth in 40 CFR Part 263, "Standards Applicable to Tranporters of Hazardous Waste" would apply to the transportation of the wastes if the waste piles were removed. Tranporters are required to obtain an EPA identification number from the EPA Administrator prior to the movement of the material, and the material must be registered in accordance with the manifest system requirements.

Cost

The capital costs for this alternative would be $22,000. This includes the cost for removal and disposal of the two waste piles which was estmiated at $10,000. Detailed costing information can be found in Appendix F.

The present worth value of the total costs for 30 years at a 10 percent discount rate would be $617,000.

A five percent sensitivity factor was included for the capital costs for the waste pile clean-up because of the volume to be removed. This would cause the total costs to vary from $568,000 to $691,000.

ALTERNATIVE 3 - Monitoring, Waste Pile Removal, Groundwater Recovery, Water Treatment, and Soil Flushing

If this alternative were implemented, the monitoring program would be established and the waste piles would be removed. Also, the contaminated groundwater would be removed, treated, and then flushed though the abandoned drum area.

The evaluation of the previous alternative also applies here. This section only present the evaluation of groundwater removal, treatment, and flushing of the abandoned drum area.

Effectiveness

Groundwater recovery through the use of pumping wells is a proven technology. An extraction well system could also effectively control the migration of contaminated groundwater. If periodic operation and maintenance requirement of the recovery systems were met, the system should last the effective life necessary to complete the objectives of the alternative.

The two alternate groundwater treatment systems proposed for this alternative are composed of unit processes which have proven their performance in many water and wastewater treatment applications. The use of either of these systems would provide a high level of public health and environmental protection by removing the majority of contaminants associated with the groundwater in the surficial aquifer. The groundwater treatment process would continue until appropriate ARARs are met or until the determination has been made that further treatment would not be effective.

The effectiveness of soil flushing is very site and contaminant specific. This technology would prove beneficial for removal of sparingly soluble compounds. In addition, the reintroduction of treated water would decrease the time required for aquifer remediation by increasing the rate of groundwater flow in the surficial aquifer. The useful life of this system should far exceed the time required for groundwater treatment.

Either treatment system described would effectively eliminate the contaminants associated with the groundwater in the surficial aquifer. Reclamation of this aquifer would prevent vertical migration of the contaminants to the Floridan aquifer as well as off-site migration to nearby surface waters. Residual risks would center around those contaminants associated with the subsurface soils. These sparingly soluble contaminants could be released, at various rates, following the cessation of the groundwater removal process. The inclusion of soil flushing in this alternative would address the majority of this problem.

The remaining risk, soil ingestion, would be identical to that found earlier. As discussed earlier, the risk involved with soil ingestion is estimated from the maximum concentrations observed, but soil ingestion is considered unlikely.

A significant decrease in the potential risk of harmful environmental impacts would result from the recovery of contaminated groundwater. The reduction in environmental risk would also be true for this alternative. Negligible risk would remain if this alternative is implemented.

Implementability

In-situ treatment processes are not as well developed or demonstrated as other more conventual technologies. Of the various in-situ technologies, soil flushing has been shown to be one of the more effective and easily

Implementing the soil flushing technology at the site should not present a problem. The benefits of the system would be facilitated by the relatively shallow depth of contaminated soil (4 to 6 feet). The time required for installation of the spray irrigation system should be short.

The materials and components needed to construct a pumping system are readily available. Construction of the wells would require experienced drillers. Constant monitoring for vapors would be necessary during drilling. The well installation should be completed in a six-month period. Scheduling of materials and labor would have to be planned so that they were available on-site when needed.

No factors should affect the construction of the treatment facility. The majority of the unit processes in either treatment system could be built above ground. The time required for implementing the water treatment portion of this alternative could be extensive. Prior to construction, it would be necessary to conduct laboratory and possibly pilot scale studies to obtain information necessary to design the full scale facility. Following the construction, the system could be put on-line.

Both treatment systems, particularly treatment system one, would require chemical handling during their operation. In addition, the potential would exist for plant operator exposure to the groundwater contaminants. In both instances, worker risk should be minimal and easily controlled using standard safety procedures.

Pumps would need to be inspected at regular intervals to detect any wear or deterioration because of contact with contaminated groundwater. Flow rate analyses and inspections should also be conducted regularly. The analytical equipment, flow rate equipment and methods of inspection are readily available. Groundwater recovery systems utilizing pumping wells have been studied and used in controlling contaminated groundwater migration at other sites.

Impacts on local and regional environmental receptors during implementation of this alternative would be minimal. However, any treated water that would be discharged has the potential to impact on the environment. This impact would stem from trace levels of contaminants and nutrients which might be present in the effluent. Nutrient levels are of particular importance since the water will ultimately discharge to the already euthrophic Lake Apopka.

Implementation of this alternative would require permits from the State for the removal of the groundwater and the installation of the wells. Any point source discharge from the treatment facility may be regulated under the Clean Water Act (CWA). In addition, transportation of the solids to an off-site RCRA landfill would be subject to 40 CFR Part 263, "Standards Applicable to Transporters of Hazardous Waste".

Cost

The Capital costs for this alternative would be $6,684,000. The capital costs for the groundwater recovery system and soil flushing would be $33,000 and $432,000, respectively. As described in the Feasibility Study, two treatment schemes would be feasible for this site. The capital cost for treatment system 1 would be $6,197,000, and the cost for treatment system 2 would be $2,570,000. All the following costing tables contain only the costs for the first treatment system.

Operation and maintenance costs would include experienced personnel for the groundwater treatment plant. The annual operation and maintenance costs for treatment system 1 and treatment system 2 would be $302,000 and $258,000, respectively. Again, only the cost for the first treatment system is presented on all the following tables. Routine inspections would also be necessary for both the recovery system and the soil flushing program. The present worth value of total costs for 15 years at a 10 percent discount rate would be $9,638,000.

A twenty percent sensitivity factor was included for the capital costs and operation and maintenance costs for the groundwater recovery system, treatment plant, and soil flushing programs because of the various assumptions which were made in calculating the volume of water necessary for treatment and the extent of contaminated soils. This analysis resulted in a variation in total present worth costs from $7,832,000 to 11,469,000.

Analysis of the Alternatives that Attain Applicable or Relevant and Appropriate Federal Public Health and Environmental Requirements

ALTERNATIVE 4: Monitoring, Waste Pile Removal, Groundwater Recovery, Water Treatment, Sediment and Surface Water Removal, and Gapping

If this alternative were implemented, the monitoring program, removal of the waste piles, the groundwater recovery system, and the water treatment

process discussed earlier would be established. The sediment and surface water would be removed from the contaminated areas in the northern, middle, and southern ditches, the Douglas Fertilizer ponds, and the two ponds in the southwest section of the abandoned drum area. Disposal of the sediments at an approved facility would be necessary under this alternative. Also included would be the capping of the abandoned drum area.

The evaluations of the previously described technologies also apply here. This section only presents the evaluation of sediment and surface water removal and capping the abandoned drum area.

Effectiveness

Caps have been demonstrated to be an effective method of minimizing the infiltration of surface water or rainwater. Regrading and revegetation would assist in reducing the volume of water that reaches the cap barrier. The expected design life of the proposed cap system would be required to insure cap integrity. With proper upkeep, the cap could last indefinitely.

Dredging and pumping would be effective in removing the sediments and surface waters onsite. The depth of surface water in the ditchlines is relatively shallow (less than 1 foot), which should permit efficient removal of the contaminated surface water and sediment. The location of the ponds would allow for easy access for pumping and sediment removal equipment.

The alternative addresses all the contaminated media discussed earlier where potential human contact could occur. The only remaining areas with contamination not remediated are several low level subsurface soil areas where there should be little to no potential for exposure.

All potential environmental impacts associated with contaminated surface water and sediment and contaminated surface soils in the abandoned drum area would be eliminated by implementing this alternative.

Implementability

The techniques required for the removal of the sediment and surface water would involve standard and well proven construction practices. The ability to locate a party to complete this work should not present a problem and costs would be relatively low.

The theoretical amount of time required for removing the 2,430 cubic yards of sediment, at an excavation rate of 1,043 cubic yards per day, would be approximately three days. The time requirement would be extended due to pond draining, sediment dewatering, and equipment relocation but

this should be minimal. Beneficial results from the implementation of this technology would occur immediately following completion.

Operation and maintenance procedures for the cap would be minimal, requiring routine inspection and repair of erosional effects and subsidence. Cover top maintenance would be modest, consisting primarily of preventing undesirable species from becoming established and penetrating the cap.

There are no factors which should prevent the completion of this alternative. The ability to locate a source for cap components should not present a problem. Time required for cap installation would be approximately nine months.

Impacts on local and regional environmental receptors during Implementation would be negligible if good work practices are employed.

Cost

The total capital costs for this alternative would be $8,531,000. The capital costs for capping and sediment and surface water removall and disposal would be $1,292,000 and $987,000, respectively.

No operation and maintenance costs should be incurred for sediment and surface water removal. The operation and maintenance costs for capping would include inspections and cover crop maintenance. The annual operation and maintenance costs would be $768 and the present worth of the total costs for 30 years at 10 percent rate would be $11,461,000.00.

A ten percent sensitivity factor was included for capital costs for capping and the surface water and sediment removal since both the areas to be capped and the volume of surface water and sediment to be removed could vary. This analysis resulted in a variation in total costs from $9,472,000 to $13,475,000.

ALTERNATIVE 5: Monitoring, Waste Pile Removal, Groundwater Recovery, Water Treatment, Soil Flushing, and Sediment and Surface Water Removal

If this alternative were implemented, it would be identical to the previous alternative except that soil flushing would be used in the abandoned drum area rather than capping. Since all the technologies have been discussed in previous sections, only the cost evaluation is presented in this section.

Cost

Capital costs for this alternative would be $7,671,000. The present worth of the total costs at 10 percent discount rate for 30 years would be $10,625,000. The sensitivity analysis resulted in a variation in total costs from $8,720,000 to $12,555,000.

Analysis of the Alternative that Exceeds Applicable or Relevant and Appropriate Federal Public Health and Environmental Requirements

ALTERNATIVE 6: Monitoring, Waste Pile Removal, Groundwater Recovery, Water Treatment, Sediment and Surface Water Removal, Excavation, and Onsite Incineration

If this alternative were implemented, the abandoned drum area, the temporary sludge storage area, and the two closed percolation ponds would be excavated and backfilled. This material, as well as the two waste piles and all sediment removed, would be incinerated onsite. Due to the excavation procedures, regrading and revegetation would be necessary. This alternative would also include groundwater recovery and treatment, sediment and surface water removal, waste pile removal, and the monitoring program previously discussed.

This section only presents the evaluation of excavation, backfilling, and onsite incineration since these technologies have not been previously discussed.

Effectiveness

Excavation involves standard construction practices and would be effective in removing contaminated soil from the three designated areas. The risk of leaving isolated pockets of contaminated soil would be eliminated by excavating to the water table. Backfilling is also a well established practice and the ability to locate an offsite source of fill should not present a problem.

The use of an incinerator for the processing of hazardous materials has been well documented, and should be effective in destroying the principal organic hazardous contaminants (POHC) present in the soils and sediments. Disposal of fly ash and any material not selected for incineration in an offsite approved landfill would prevent any further onsite contamination associated with these sources.

The time required for waste pile removal, excavation, and sediment removal would be approximately seven months. Using a single, mobile, rotary kiln incinerator operating 24 hours per day, the time required to incinerate the estimated 47,825 tons of material would be approximately 1.25 years which includes a 15 percent downtime.

Implementation of this alternative would, in a relatively short time, eliminate the public health risks associated with the site. This would be achieved through source removal, treatment, and destruction. The possibility would exist for isolated areas of contamination to remain. However, these areas should be small with sufficiently lowered contaminant concentrations.

Implementability

Excavation, backfilling, and the removal of material to an offsite landfill are proven techniques and have been used effectively in similar situations.

The use of incinerators for the thermal destruction of hazardous waste is well documented; however, an evaluation of trial burn results would be necessary for the selection of optimum operational parameters and treatment requirements. Incineration would involve extensive operation and maintenance requirements for efficient operation.

The excavation and backfilling procedures would involve the use of heavy equipment, and therefore would present some safety concerns. This concern would be amplified due to the amount of time (seven months) required to complete the excavation and sediment removal process. Safety considerations for onsite incineration would center around worker exposure to site contaminants during incinerator loading and handling of thermally refractive material.

There are no factors which should prevent the implementation of the excavation and incineration portions of this alternative. However, careful coordination among the various components would be required for efficiency to be maintained. The implementation of this alternative would have the potential to negatively impact the public health. The technologies of concern include sediment and surface water removal, excavation, and on-site incineration. Sediment and surface water removal have been previously discussed. During the excavation procedure, the potential for off-site migration of contaminants would be increased. Pathways for this migration would include airborne particulates, volatile organic vapors, and surface runoff. Receptors in the area of the site would be susceptible to inhalation of vapors as well as contaminant-laden particulates, the ingestion of particulates, and direct contact with the excavated soils.

Incineration could also produce some public health risk. These risks would primarily arise from emitting products of incomplete combustion (PICs). PICs could result not only from the waste material, but from the auxiliary fuel as well. The particular PICs emitted would be dependent on the waste and incinerator operation parameters. Receptors in the path of the incinerator plume could inhale these emissions.

Other factors having an impact on public health would be the storage of the material prior to incineration and the offsite transportation of fly ash and the material not selected for incineration. Storing the waste onsite would increase the chance of contaminant loss due to volatilization and surface runoff. Transporting the waste offsite would have the potential to increase receptor exposure to fugitive gas emissions, dust, and direct contact in the event of an accidental spill.

Incineration should not be expected to add significantly to the environmental impact. However, environmental receptors in direct line with the incinerator plume could be subject to emissions. The use of air pollution devices would keep air emissions within compliance standards and relieve

environmental stress. Any negative environmental impact that might result from incineration would be further reduced due to the short amount of time (1.25 years) estimated to complete the incineraiton process.

This alternative through source reduction treatment and destruction would alleviate the majority of the contamination at the site. Therefore, implementation of this alternative would be expected to mitigate any further environmental impact.

The incineration of hazardous waste is regulated under RCRA; therefore, the onsite incinerators would have to operate within these requirements. Additional state and local regulations could include solid waste storage and air quality emissions requirements. The ash generated by incineration would have to be disposed of in an approved landfill. The transporter requirements discussed would also be applicable to this alternative.

Cost

Capital costs for the onsite mobile incineration facility would be $27,911,000. The capital cost for incineration would include the offsite disposal of fly ash in a local approved landfill as well as disposal of materials not selected for incineration. The costs for excavation were based on a unit crew which would include one front-end loader. The capital costs for excavation would be $820,000.

The operation and maintenance costs for excavation would include periodic inspections and cover crop maintenance. The present worth at a 10 percent discount rate and 30 years for the total costs would be $38,031,000.

The volume of material that would be excavated and the amount of material that could be incinerated have the greatest impact on costs. A 20 percent variation in the volume of material and a 30 percent variation in the volume reducted by incineration was used. This caused the present worth costs to vary from $27,721,000 to $48,365,000.

Analysis of the Alternatives that Specify Offsite Disposal

ALTERNATIVE 7: Monitoring, Waste Pile Removal, Groundwater Recovery, Water Treatment, Sediment and Surface Water Removal, Excavation, and Offsite Disposal

If this alternative were implemented, it would be identical to the previous alternatives, except that the excavated material, sediment, and waste piles would be disposed of in an offsite EPA-approved RCRA landfill instead of being incinerated onsite.

Since all the technologies that compose this alternative have been previously discussed, this section only presents the evaluation of the disposal of contaminated soils and sediment in an offsite EPA-approved RCRA facility.

Effectiveness

Disposal in an offsite landfill would be a permanent remedial action for the Zellwood Groundwater Contamination Site and would provide a high level of environmental and public health protection. This alternative, through source removal, would prevent any further migration of contamination.

Implementability

The implementation of this alternative would present some logistical problems. These would primarily concern the coordination of excavation rate and transportation. The estimated time that would be required for excavation and sediment removal is seven months. Transportation of the excavated material offsite would be done in trucks with a 20 cubic yard capacity and would require approximately 2,400 shipments.

The ability to secure transporation for the removed material should not present a problem. The performance of EPA-approved RCRA landfills has been demonstrated for the disposal of hazardous waste.

The majority of the health effects that would be associated with implementing this alternative have been previously discussed. Additional concerns would involve moving the material outside the confines of the site.

Public acceptance considerations, in addition to those previously discussed, would involve the transport of the exhumed material. Increased traffic generated by the transport of material might create some disruption, but attention to routing and scheduling should increase public tolerance.

Cost

The total capital costs for this alternative would be $25,419,000. Capital costs for off-site disposal would include tranportation and disposal fees. The disposal fee is based on the costs at the EPA-approved RCRA landfill in Emelle, Alabama. These costs are approximately $30 less per ton than the disposal fee at the Pine Wood, South Carolina facility.

Operation and maintenance costs for the revegetation of the backfilled material were based on four times per year. The annual operation and maintenance costs for this alternative would be $458,648. The present worth at a 10 percent discount rate and 30 years for the total costs would be $28,349,000.

A sensitivity analysis was performed on various components of this alternative. The most significant of these concerned the volume of waste to be excavated and tranported to an off-site landfill and a 20 percent difference in the volume was used. The sensitivity analysis resulted in a present worth cost variation of $22,853,000 to $33,870,000.

ALTERNATIVE 8 - Monitoring, Waste Pile Removal, Groundwater Recovery, Water Treatment, Sediment and Surface Water Removal, Excavation, and Off-Site Incineration

If this alternative were implemented, the soils, sediments and waste piles would be excavated and incinerated off-site. Due to the excavation procedure, regrading and revegetation would be required. This alternative would also employ the groundwater recovery and the water treatment process and the monitoring program.

This section will present the evaluation for off-site incineration since the remaining technologies have been previously evaluated.

Effectiveness

Incineration would be effective in destroying many of the contaminants at the site. Source removal with off-site incineration would prevent further contamination associated with the soil and sediment, thereby providing substantial environmental and public health protection.

The performance of incineration for the destruction of hazardous waste has been well documented. The operation and maintenance, similar to the use of an off-site landfill, would be minimal.

The implementation of this alternative should effectively negate any residual risk associated with the site contaminants. The possibility would exist for isolated areas of contamination to remain. However, these areas should be small with sufficiently lowered contaminant concentrations.

Implementability

The logistical problems would also be applicable to this alternative. The nearest appropriate commercial incinerator to the site is located in Calvert City, Kentucky approximately 850 miles away. This facility has the capacity to incinerate 297 tons per day; and therefore, could theoretically dispose of the excavated soils and sediments in a few months.

Since commercial incineration facilities require that the material be incinerated is contained in a drum or fiberpack; this would eliminate the release of particulates and fugitive gases during transportation.

The transporter requirements would also be applicable to this alternative. In addition, the commercial incineration facility must be in compliance with all applicable standards of Federal environmental and public health statutes.

Public acceptance of this alternative would be the same as that discussed in off-site landfilling.

Cost

The captial costs for this alternative would be $45,158,000. Capital costs for off-site incineration would include tranportation and incineration fees. The incineration fee was based on the costs at the EPA-approved RCRA incinerator in Calvert City, Kentucky. These costs are approximately $900 less per ton than the incineration fee at the Rock Hill, South Carolina facility.

Operation and maintenance costs for the revegetation of the backfilled material were based on four times per year which would make the annual operation and maintenance costs $457,880. The present worth for 30 years at a 10 percent discount rate for the total costs would be $48,088,000.

A sensitivity analysis was performed on various components of this alternative. The most significant of these concerned the volume of waste to be excavated and transported to an off-site incinerator and a 30 percent difference in the waste volume was used. The sensitivity analysis resulted in a present worth cost variation of $34,761,000 to $61,439,000.

Analysis of Additional Alternatives

ALTERNATIVE 5A - Monitoring, Waste Pile Removal, Groundwater Recovery, Water Treatment, Sediment and Surface Water Removal, Off-site Disposal

After reviewing the draft Feasibility Study, it was requested of the program that an additional alternative be considered. This additional alternative would be a combination of the original Alternative 5; combined with portions of Alternative 7. This alternative was described in detail in the Fact Sheet that was developed as part of the required public comment period. This alternative was identified as Alternative 5A.

Alternative 5A consists of:

- Excavation of soils/sediments from the three existing ditches, the two ponds in the abandoned drum area, the two waste piles in the abandoned drum area, the temporary sludge storage area, and the two former Drum Service perculation ponds;

- Removal of the excavated soils/sediments to an offsite

RCRA approved facility;

- Removal and treatment of the groundwater in the shallow aquifer;
- Flushing the treated groundwater back through the abandoned drum area;
- long-term monitoring for the private well in the area.

Alternative 5A would be classified as one of the alternatives that exceeds applicable and relevent requirements. The various evaluations would be similar to the evaluations for Alternative 5. The capital costs for this alternative are approximately $11,647,000.

SECTION VI
REMEDY SELECTION

The selected remedy will consist of a combination of the various alternatives that have been presented.

Several areas have been selected for excavation. The basis of the selection of these areas was two fold: the levels of contamination that were found in the surface and subsurface soils and the historical data regarding waste water/sludge storage/runofff areas. These areas are: 1) two former perculation ponds used by Drum Service Company; 2) temporary sludge storage area; 3) three onsite ditches; 4) sludge from two existing ponds in abandoned drum area; and 5) waste piles in abandoned drum area. This will be approximately 5800 yd. of soil/sediment.

Several options were considered for the treatment and/or disposal of the excavated soil. The majority of the contamination in the excavated soils is of an organic nature. Because of this, solidification was not considered to be appropriate. Because of the upcoming land ban, off site disposal was ruled out. The appropriate treatment technology was deemed to be thermal destruction. An appropriate test will be conducted on the ash to determine final disposal.

The contaminated soil in the abandoned drum area poses a different problem. The soil is contaminated with both organics and inorganics. Thus, to either incinerate or solidify would be inappropriate. Two other options were considered. The first option consisted of capping the approximately six acre area. The second option consisted of flushing the area with clean water. Because the second option provides for a more permanent clean up of the abandoned drum area, it was selected. The abandoned drum area will be flushed with clean water until clean up has occurred.

There are two aquifers at the site. The Floridan aquifer, the lower aquifer, is separated from the water table aquifer by the Hawthorne formation. The sample results obtained during the RI did not indicate any contamination that could be related to the site. On that basis, no remediation of the Floridan aquifer is recommended. However, because the Floridan is the only source of drinking water at the site, a long term monitor program for it will be implemented.

The surficial aquifer is demonstratively contaminated throughout its entire vertical extent. The direction of flow is to the southwest; towards the muck farms. Because the surficial aquifer has been determined to be a Class I aquifer and because of concern that the surficial aquifer might

contaminate the Floridan aquifer, an active groundwater remediation program will be implemented. This will consist of an extraction and a treatment system for this water. The treated water will then be pumped back through the abandoned drum area to facilitate the cleanup of that area. It is estimated that the groundwater cleanup will take approximately fourteen years.

It is estimated that the present worth cost of this remedy is $13,543,244.

SECTION VII
COMMUNITY RELATIONS

As required by the NCP, a Community Relations Plan (CRP) was developed and submitted to the Agency for this project. Two separate repositories have been set up. One repository is located at the Zellwood Community Center. The other repository is located at the Zellwood Elementary School.

A public meeting was held on September 30, 1986 to present the findings of the RI/FS. This meeting also initiated the start of the three-week public comment period.

Less than ten written comments were received by EPA. Those comment, along with the transcript of the public meeting, are included in the Responsiveness Summary.

Appropriate Community Relations, as required by SARA, will continue throughout the RD/RA phase of the project.

SECTION VIII
COMPLIANCE WITH OTHER ENVIRONMENTAL LAWS

The applicable laws at the Zellwood Groundwater Contamination site are as follows:

- EPA's Groundwater Protection Strategy;
- Clean Water Act;
- Resource Conservation and Recovery Act, 1984 Amendements;
- National Environmental Policy Act;
- Various dredge and fill programs
- Executive Order 11990;
- Florida Class III Surface Water Standards (FAC Chapter 17-3);
- Safe Drinking Water Act;
- Florida State Drinking Standards (FAC Chapter 17-22);

By performing an RI/FS at the Zellwood site, EPA has fulfilled the requirements of NEPA.

Destruction of the contaminated soils by inceneration will have to meet the requirements of Parts 264(o) and 261 Appendix 2 of RCRA, along with Chapter 17-30 of the Florida Administrative Code. RCRA part 264 (o) governs all aspects of incineratore test burns, and RCRA Part 261 Appendix 2 governs the EP Toxicity requirements governing incineration (FAC 17-30) adopts RCRA Part 264(o) without further state-imposed regulations. Therefore, incineration activities must be conducted in accordance with applicable portions of RCRA.

SARA now has codified the requirement that EPA apply its Groundwater Protection Strategy to any site where contaminated groundwater may be of concern. In accordance with that, EPA Region IV Groundwater technology experts assessed the two aquifers (memo, Mitchell to Wright, 4/7/87). Groundwater in the surficial aquifer was classified as a Class I based, on the presence of threatened or endangered species in groundwater discharge areas. Within the two mile classification review area. The Florida aquiferr was classified as a definitive Class IIA, and could potentially be Class I. Based on these classifications, plus the site-specific data, it was determined that groundwater remediation be undertaken.

The recovered groundwater will be treated and discharged into the abandoned drum area. The discharge will meet all applicable surface water and groundwater standards.

After this remedy has been completed, there should be no further threat resulting from the areas addressed by the Superfund program. Thus, no RCRA long-term monitoring program will be required.

SECTION IX
ENFORCEMENT ANALYSIS

Four businesses currently operate at the Zellwood Groundwater Contamination site. The Drum Service Company of Florida recycles used, steel drums. The drums are recycled by incineration at a minimum of 1600°F, cooling, straightening, and painting. Wastewater is generated by the draining and cleaning of the drums prior to incineration. Oil is separated from the wastewater by an oil separator. Recovered oil is stored in a 5,000 gallon tank until it is picked up by an oil reclaimer. Prior to November, 1980 effluent from the wastewater treatment system was discharged into two evaporation/percolation ponds. Presently all effluent is reportedly recirculated through a closed loop system and used as conveyor chain cooling water in the incinerator system.

Drum Service Company of Florida currently leases the business property from NAPA Inc. NAPA also owns the property inhabited by the abandoned drum area. NAPA Inc. funded the emergency removal that was supervised by EPA in 1983. NAPA hired Drum Service to be their contractor for the emergency removal project.

Drum Service participated in the negotiations to implement the RI/FS Work Plan. The company ultimately declined to implement EPA's RI/FS Work Plan. Drum Service did submit an RI/FS Work Plan of their own; however, EPA did not accept that Work Plan as being the technical equivalent to EPA's Work Plan. EPA then offered to split the Work Plan into surface and subsurface portions; thus, allowing any interested parties to perform at least part of the RI/FS with EPA performing the rest. This offer was declined. The Drum Service Company has been cooperative about allowing site access for the investigative work. Drum Service has remained very interested in following what EPA is doing at the site.

Douglass Fertilizer, which operated on the Zellwood site from the mid 1970's to 1984, has relocated to another piece of property across Zellwood. The company currently operating on the old Douglass Fertilizer Company property, Coatings Applications and Waterproofing Company, reportedly does not require any environmental permits.

Chemical Systems Inc. leases the property it occupies from Drum Service Company. It also does not discharge any wastewater and thus requires no permit. Chemical Systems has been in business at this site since 1982.

Seaboard Railroad, which owns the railroad right-of-way on the site, was notified that they were a PRP at the initiation of the RI/FS PRP negotiations. The company showed no interest in implementing the project.

The Florida Department of Environmental Regulation (FDER) filed suit against the Drum Service Company in March 1986. The suit was to force Drum Service to bring its incinerator into compliance with applicable air regulations. As of the date of this ROD, the outcome of the suit was unknown.

The Drum Service Company and its consultant, Geraghty & Miller, Inc., has been in contact with FDER several times in regard to the EPA RI/FS. EPA, by choice, was not directly involved with these discussions.